Sheet Metal Industries

The only Journal in the World wholly devoted to the Manufacture, Manipulation, Fabrication, Welding, Assembly and Finishing of Ferrous and Non-Ferrous Sheet and Strip

VOL. 38 : No. 409 | MAY 1961 | PRICE 2/6

Editorial Contents: 315, 317

Classified Advertisements: 111 to 114

Fry's make 197...

It's a fact! 197 Different solders. There's low melting point solders—solder wires—high temperature solders—solders for silver ceramics—body patching solders—spray gun solders—electrical solders—tinplate, steel and zinc solders—and many more besides.

...not now – it's 198!

The other day we really hit a snag. We had to solder joints at a temperature below 50° centigrade. So we got straight on to Fry's. They tackled the problem at once and made up a special solder alloy for us. So that made 198—though it's probably gone up again since then.

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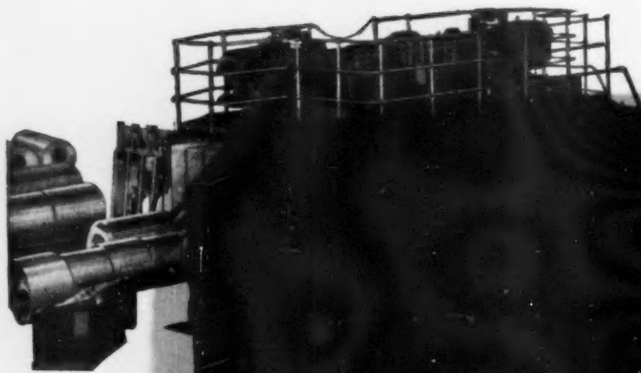

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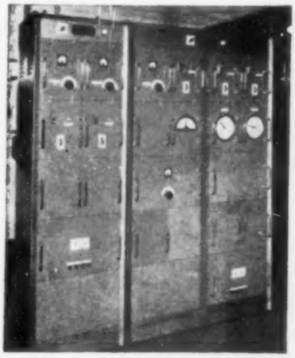
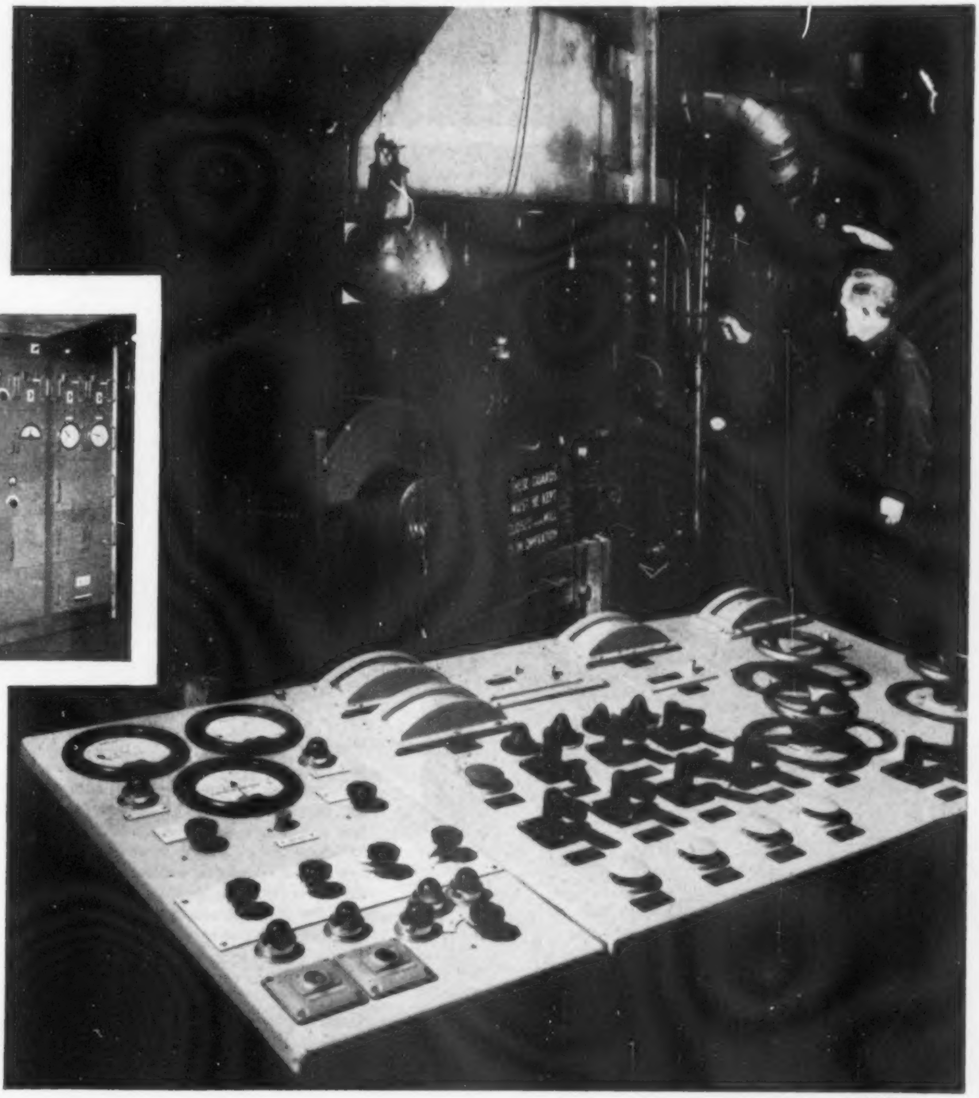
by DAVY-UNITED





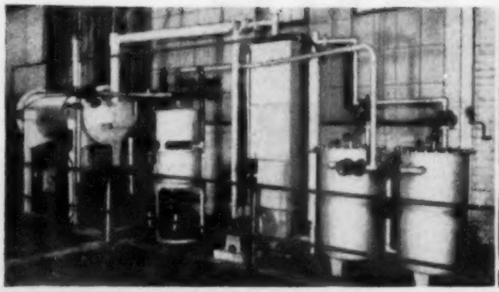
DU/317

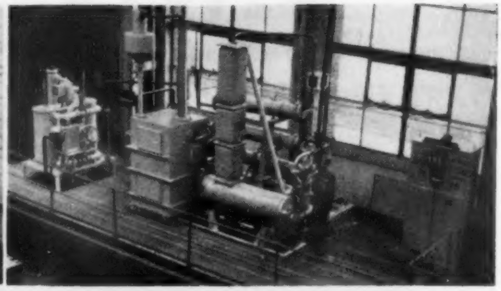
The 10½" and 28" x 24" Reversing Cold Strip Mill in the Castle Works, Cardiff, of Guest, Keen & Nettlefolds (South Wales) Limited, on which the Davy-United Gaugemeter system of Automatic Gauge Control has recently been installed.

DAVY-UNITED

DAVY AND UNITED INSTRUMENTS LIMITED, DARNALL WORKS, SHEFFIELD 9

DAVY-ASHMORE GROUP





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League Champions and Cup Finalists

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They have twice won the F.A. Cup — in 1901 and 1921. In 1950 Spurs gained promotion from the Second Division and the very next season won the First Division championship
One of the stars of that famous "push and run" team was wing-half Billy Nicholson who is now manager of possibly the greatest, and certainly the most expensive footballing side of the decade. At the start of this season, Spurs won their first ten games to break an all-time League record.

Tottenham Hotspur

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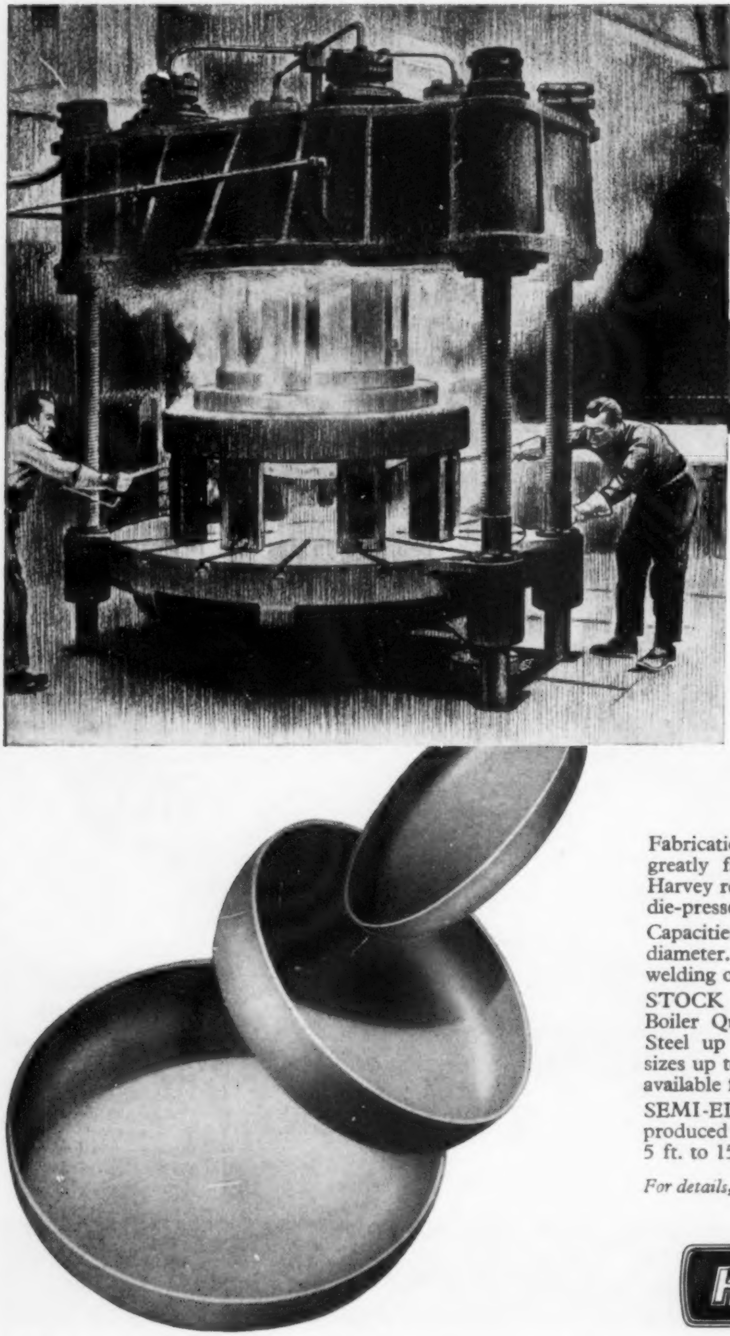

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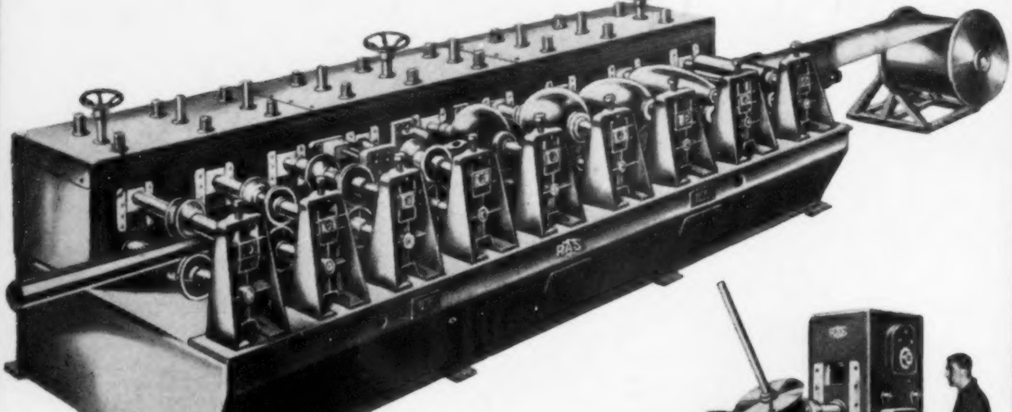

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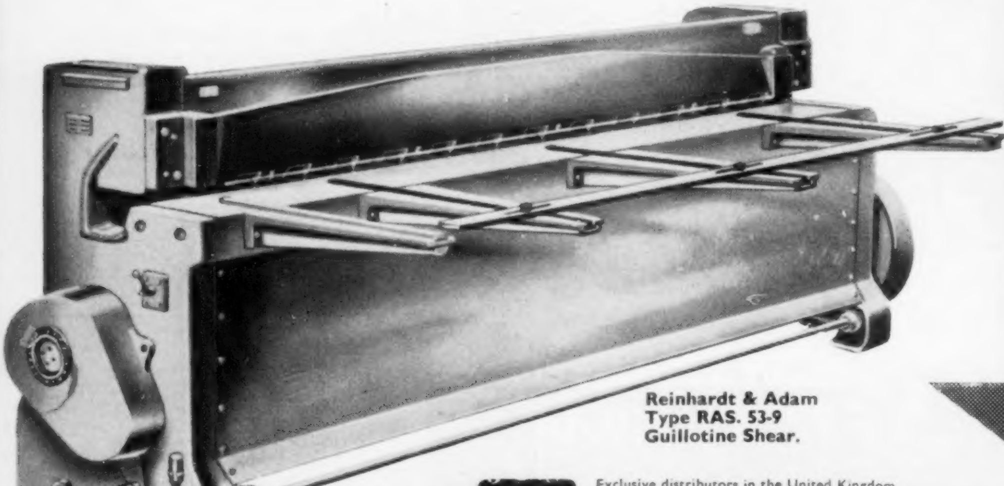

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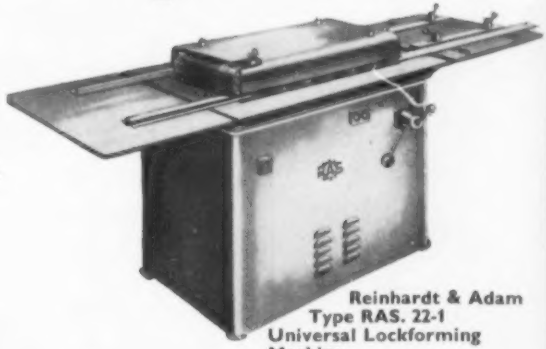

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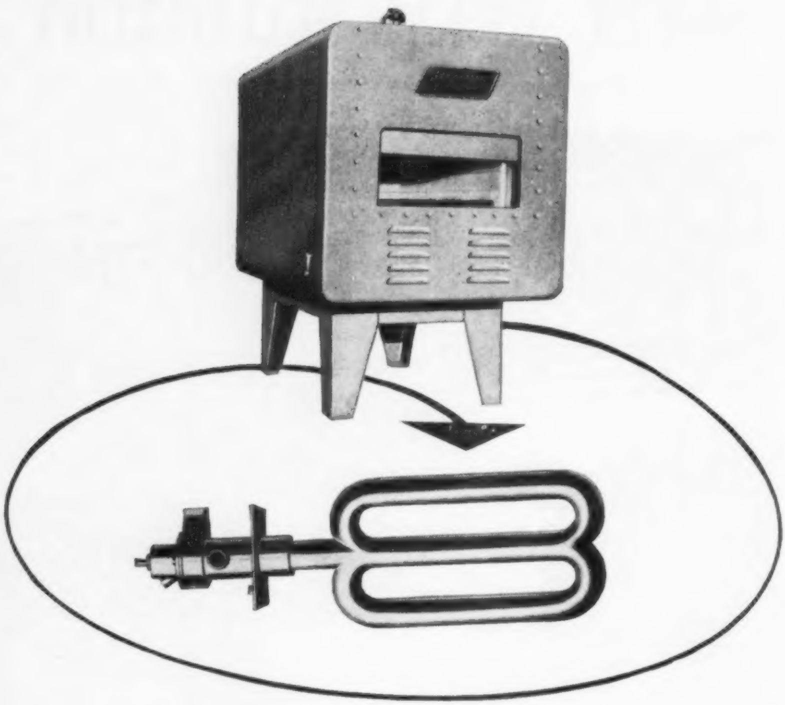

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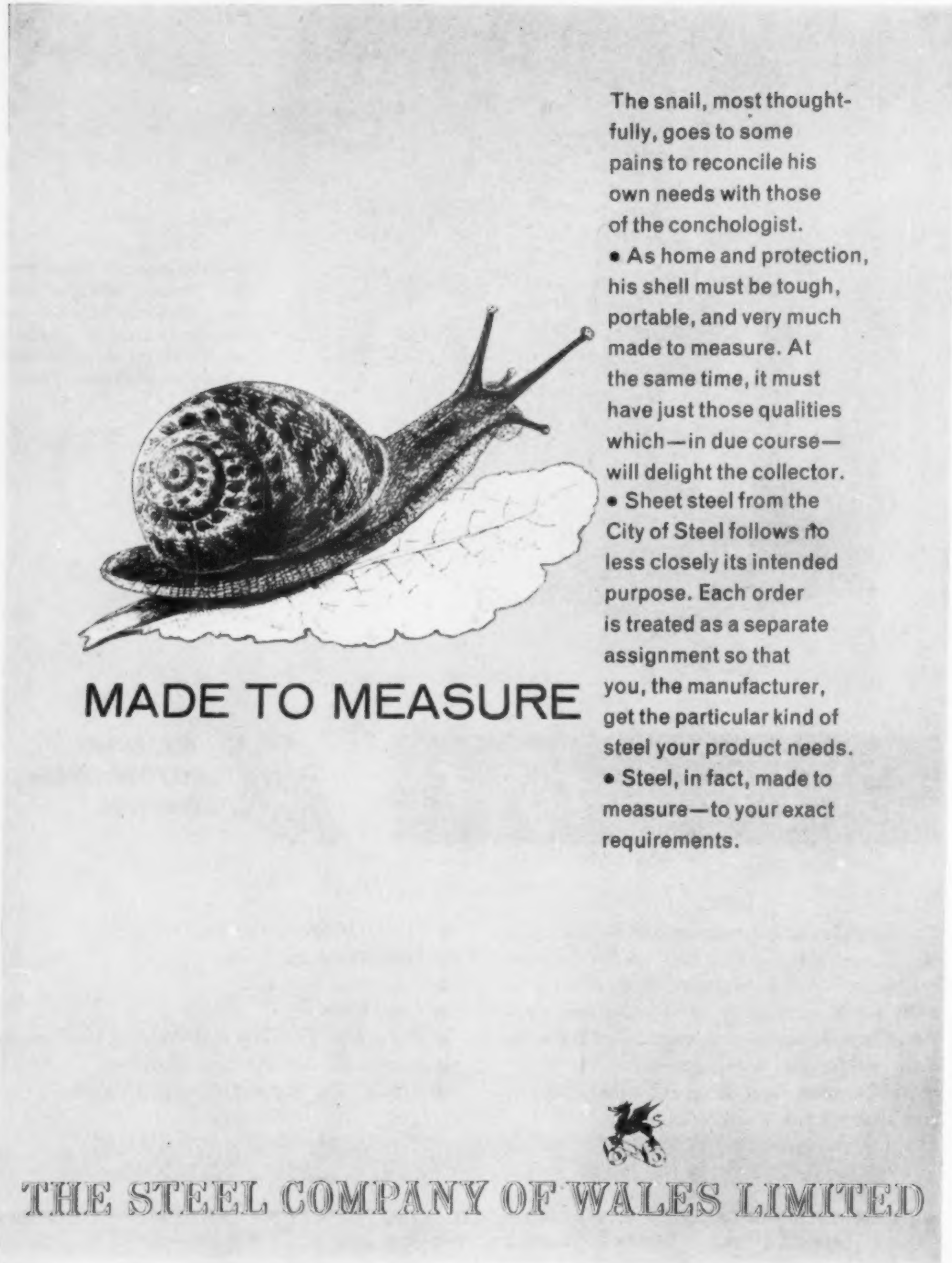
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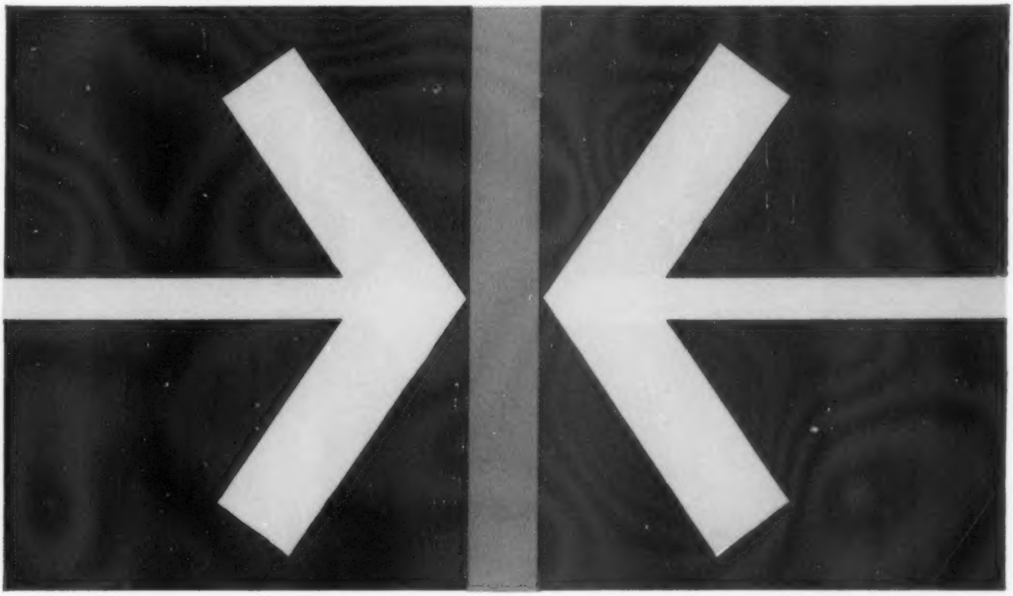

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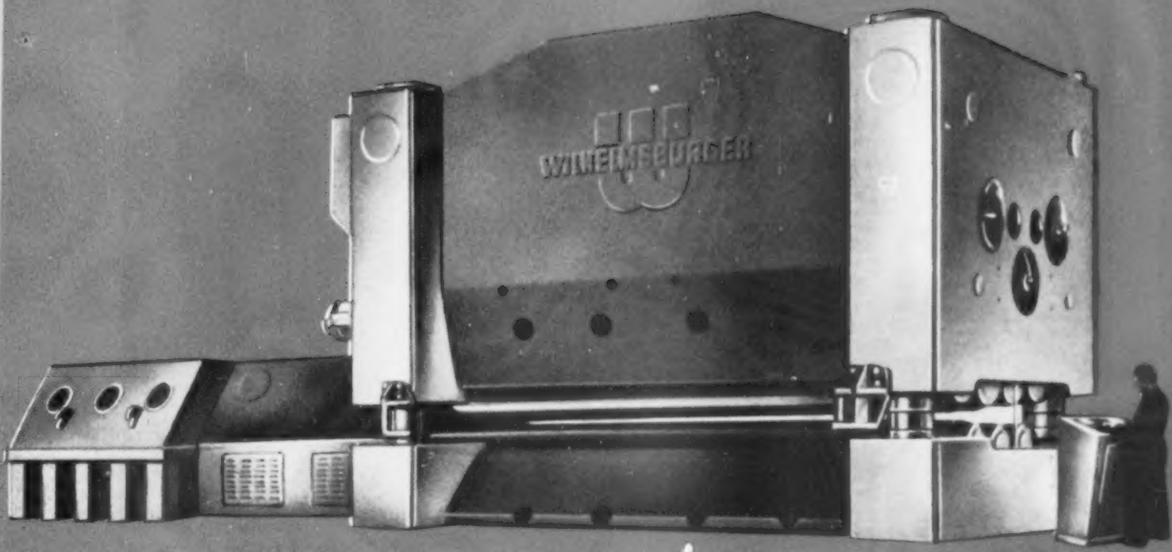
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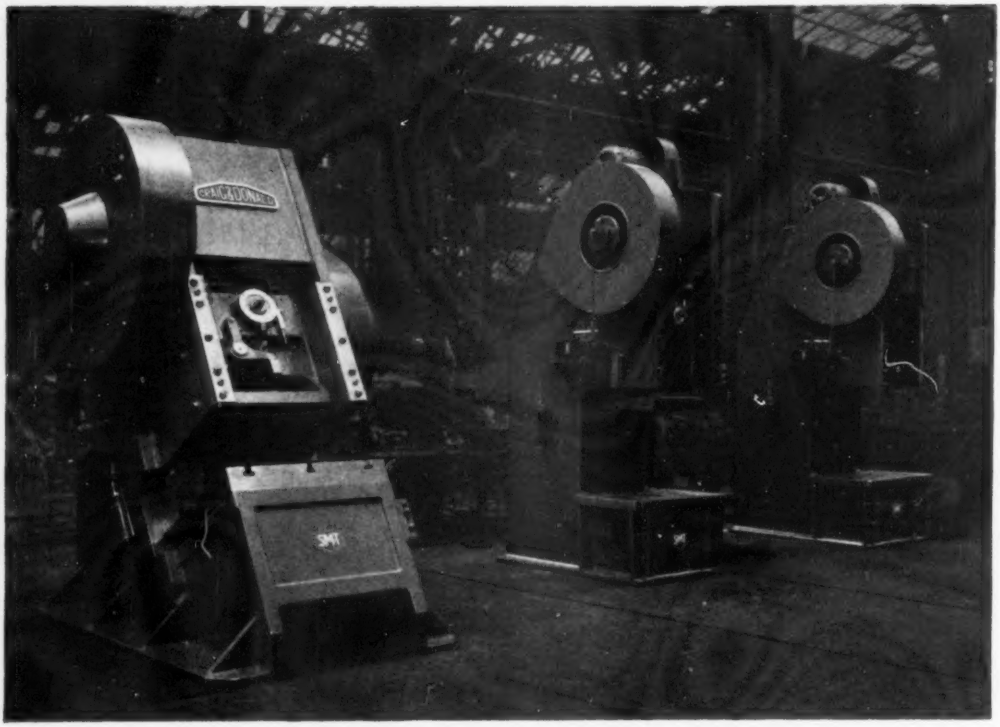

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These Presses illustrate the versatility of our system of welded all steel Press frames, and we have made many very successful Machines of this type. In the photograph, the Machine on the left is a standard Press arranged to be permanently inclined, whilst the other two Machines have extended bolsters to take our customers' tooling.

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Special tooling is available for profile forming, reforming, pipe reducing, planishing, upsetting and flattening.
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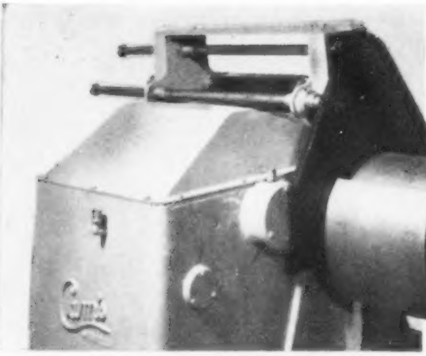

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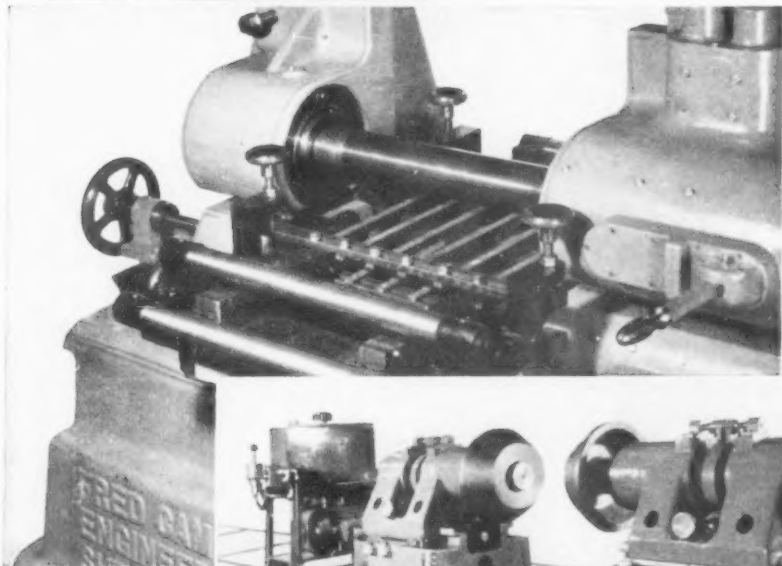

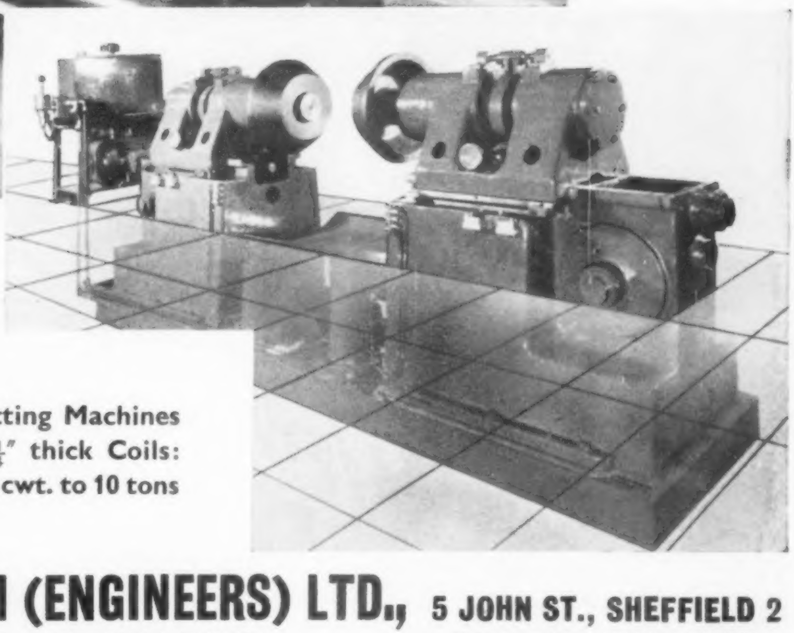

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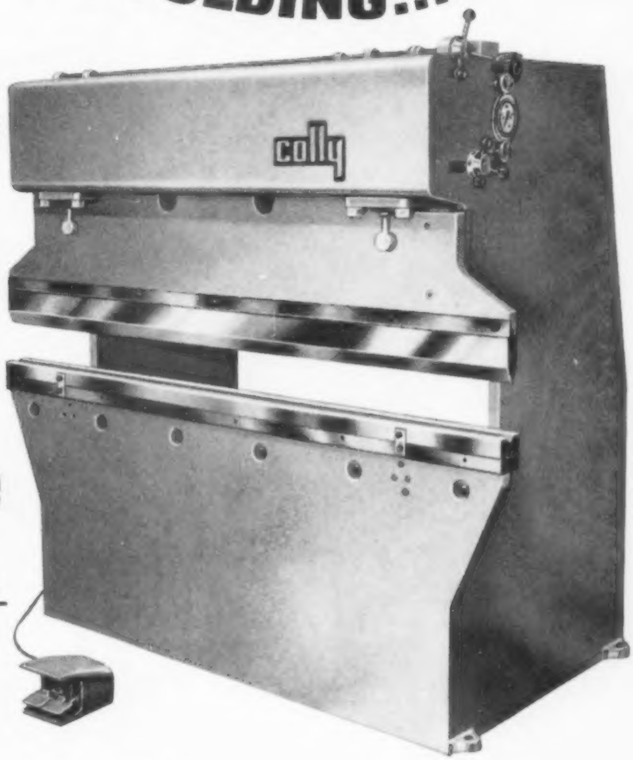
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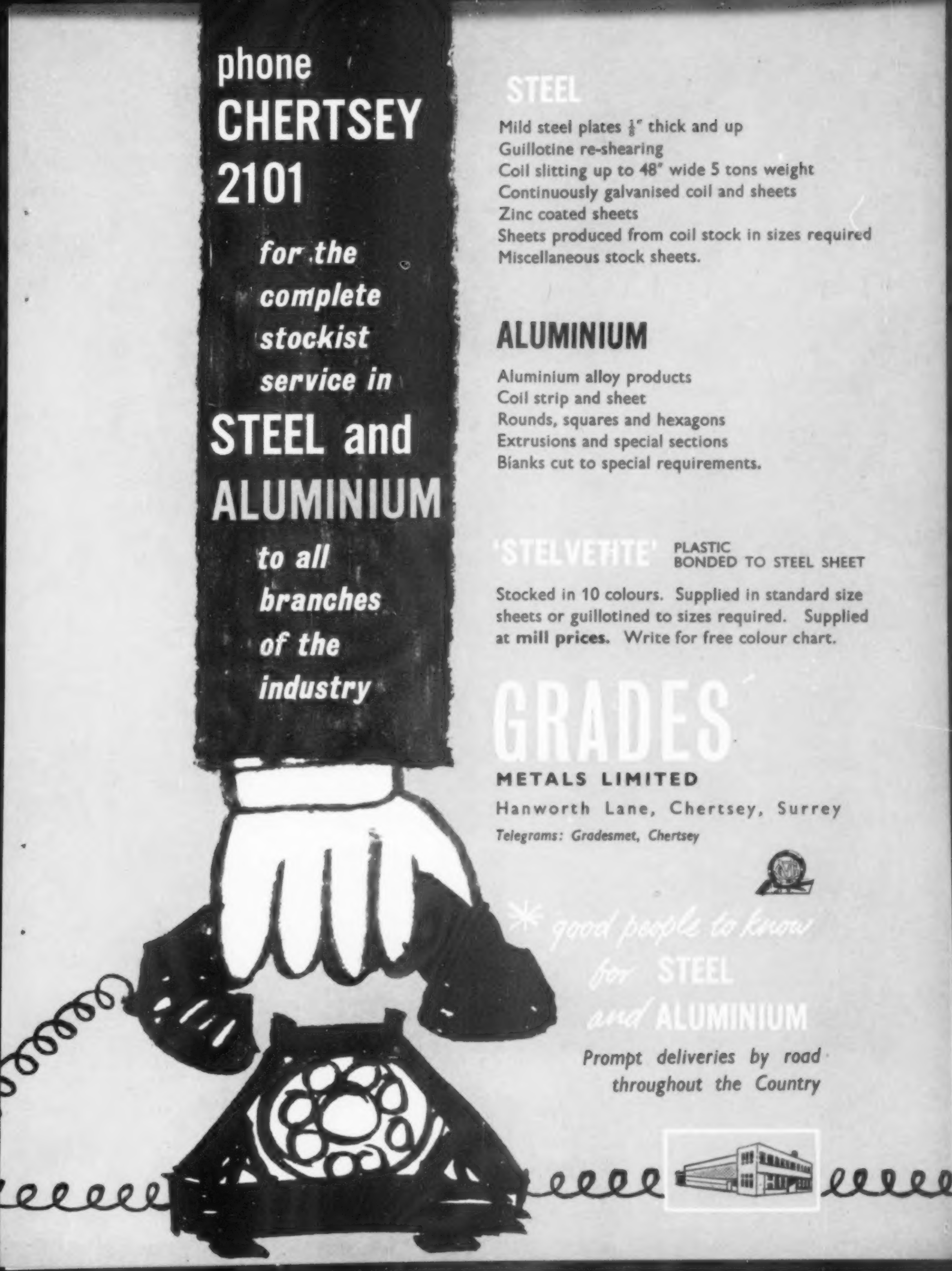
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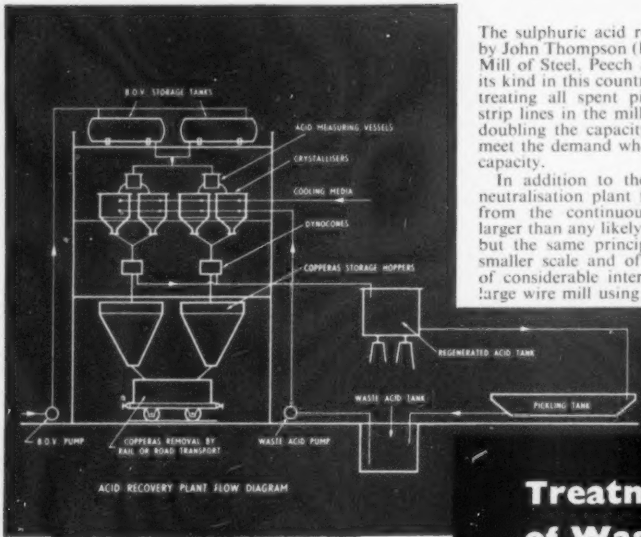

ACID RECOVERY PLANT FLOW DIAGRAM

The sulphuric acid regeneration plant recently installed by John Thompson (Dudley) Ltd., at the new Brinsworth Mill of Steel, Peech & Tozer, is probably the largest of its kind in this country. The complete plant is capable of treating all spent pickle liquors from the continuous strip lines in the mill, and provision has been made for doubling the capacity of this plant at a future date to meet the demand when the mill is working at maximum capacity.

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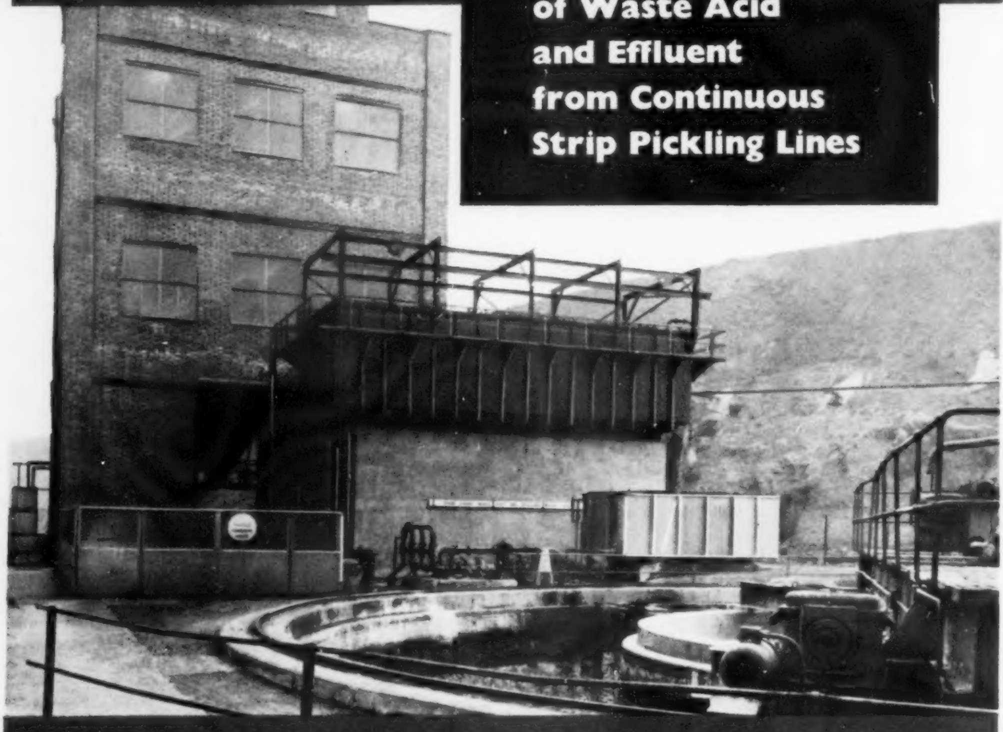

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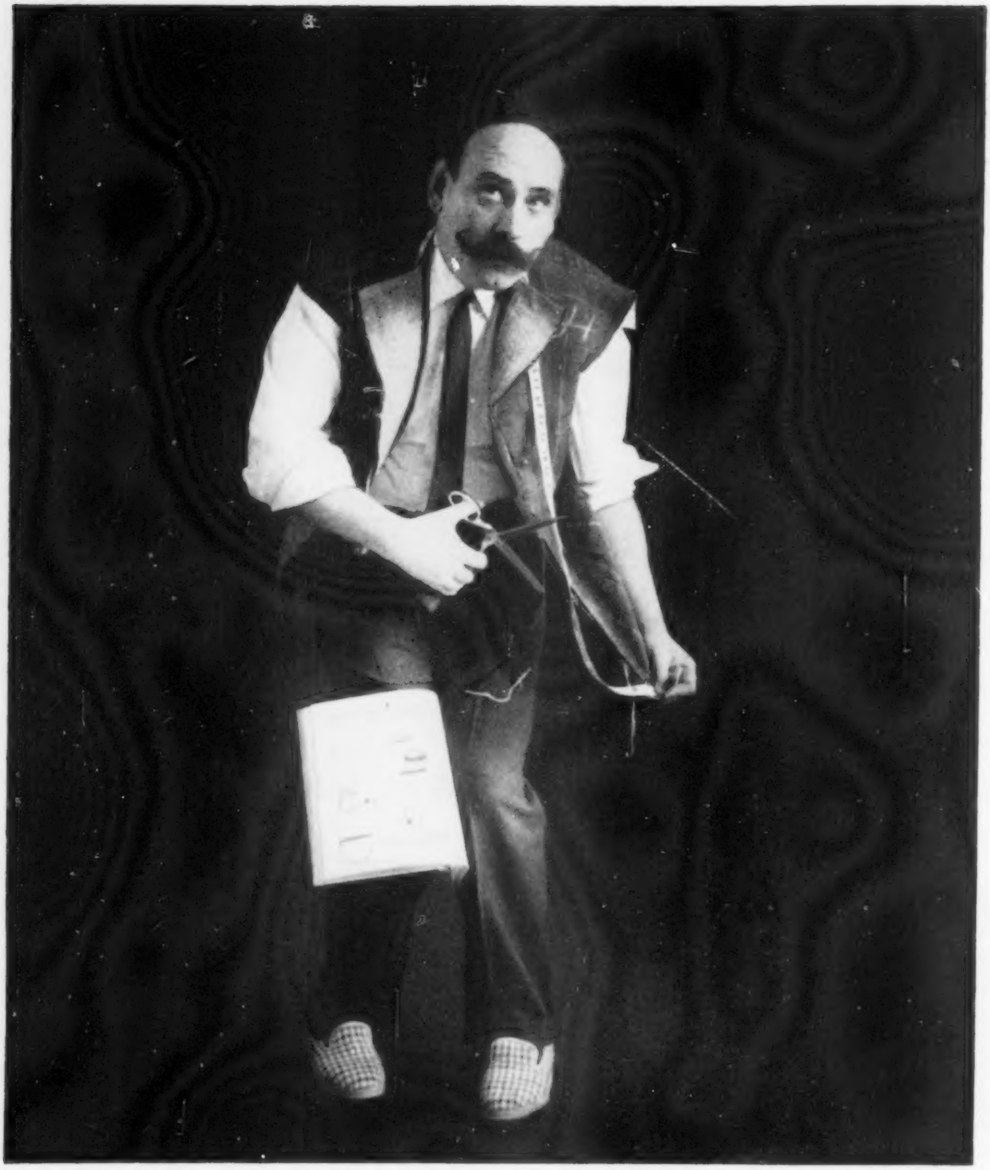

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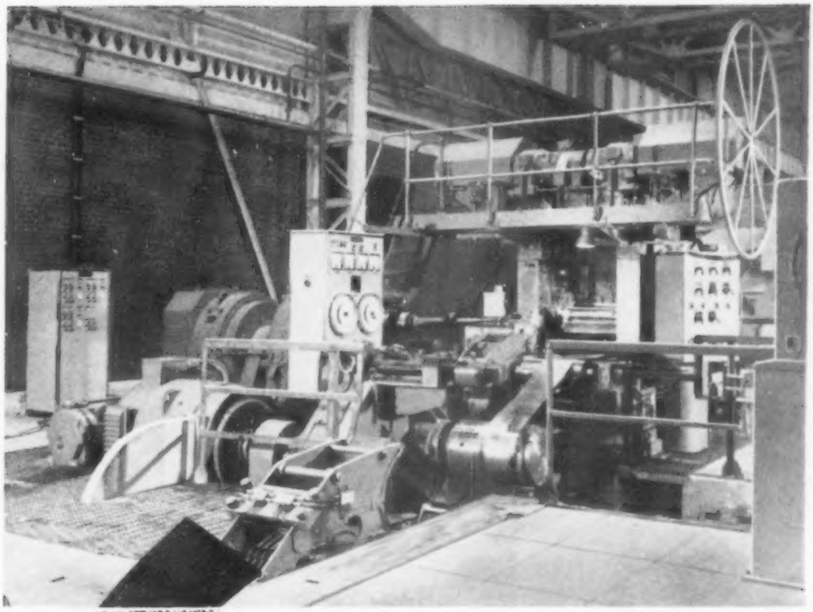

Photograph by courtesy of Steel Peech & Tozer of Rotherham.

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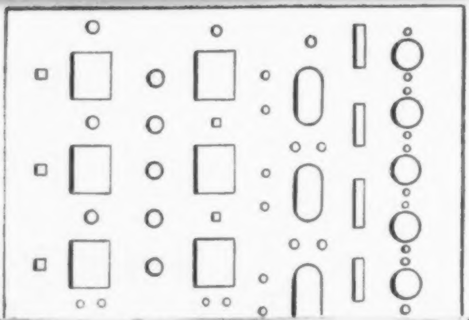

WALES

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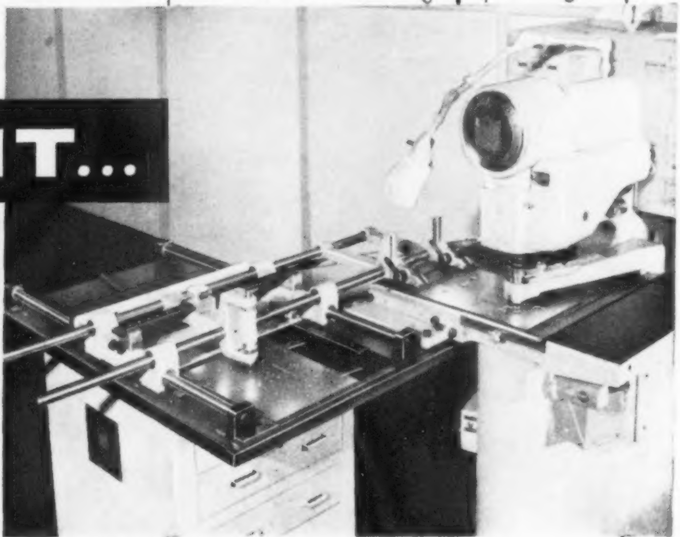

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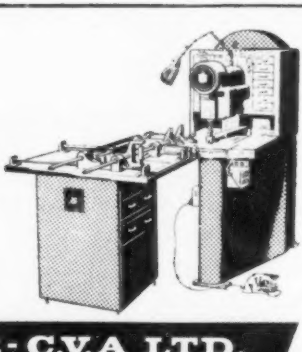
MOTOR — 1 h.p. 220/440v. 3 phase. 50 cycle

STROKES PER MINUTE — 165 for single punching or nibbling

THROAT DEPTH OF PRESS — 15"

TABLE WORKING SURFACE — 30" wide x 20" deep



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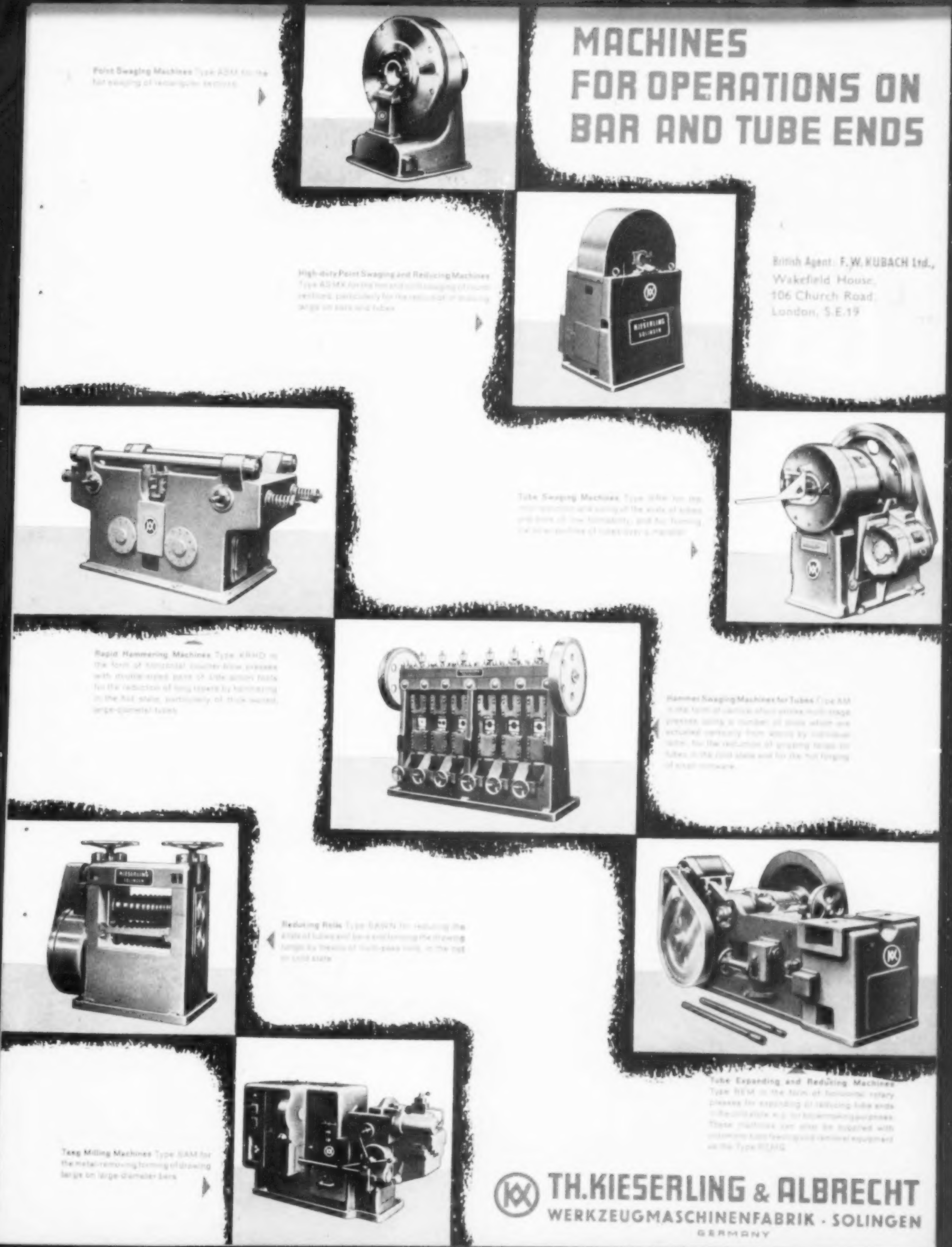
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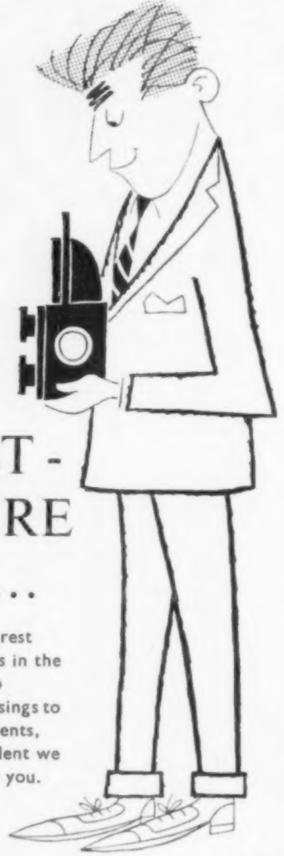

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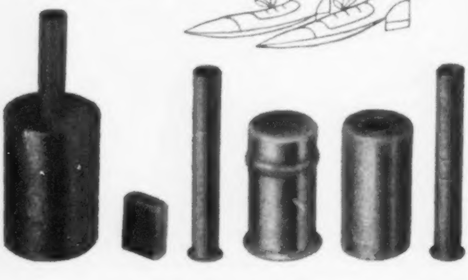

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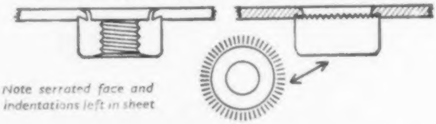

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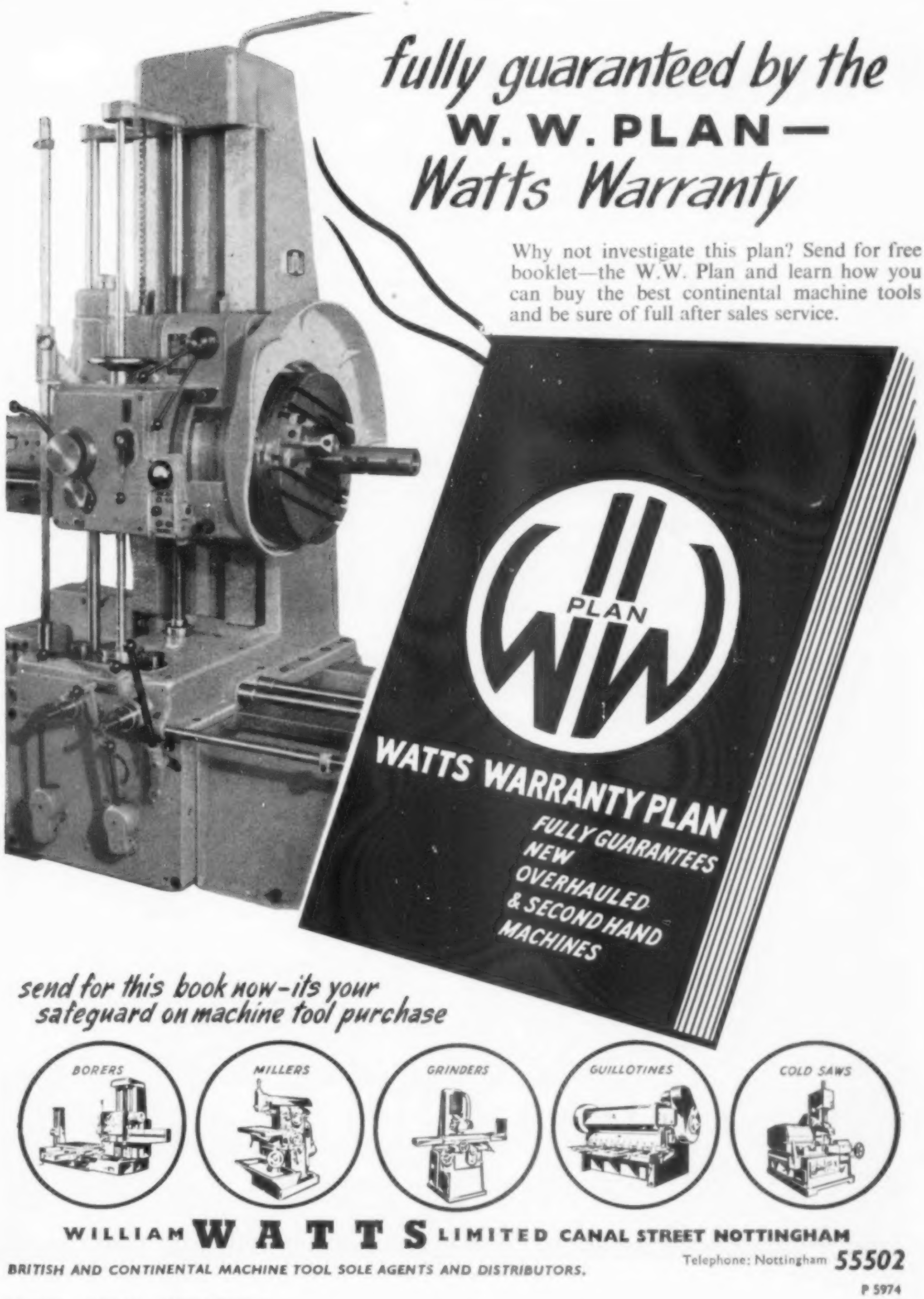
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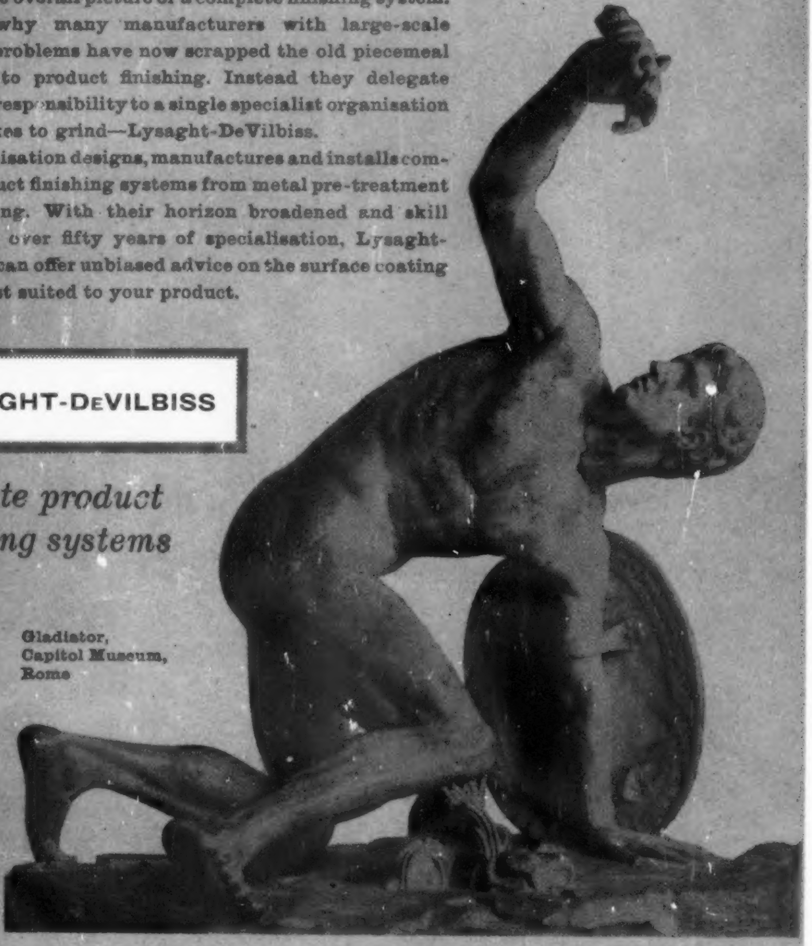

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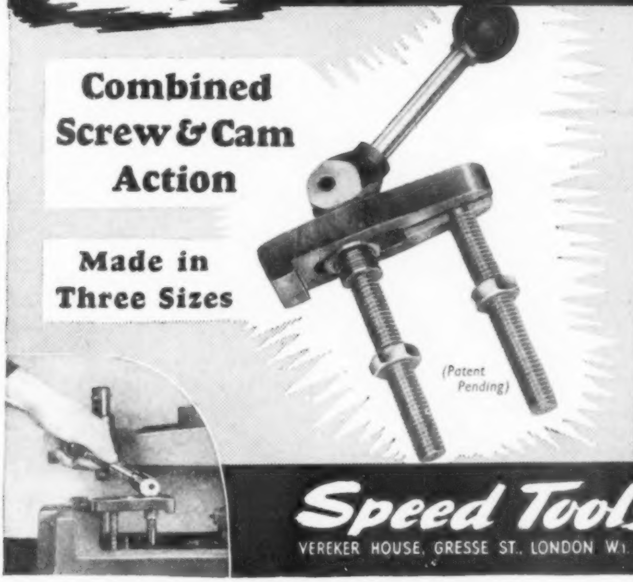

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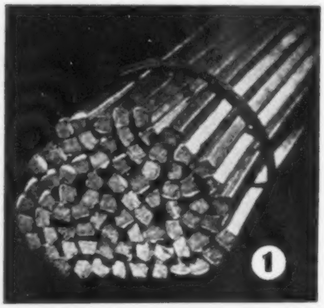

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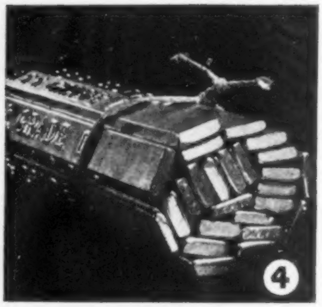

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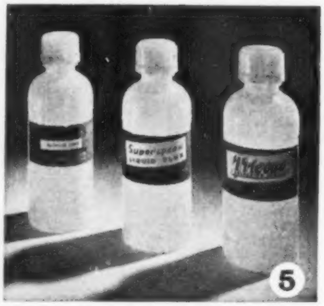

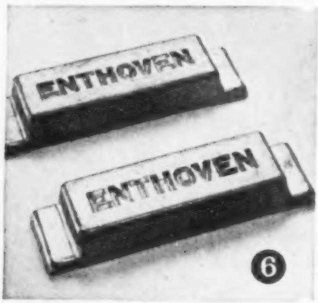

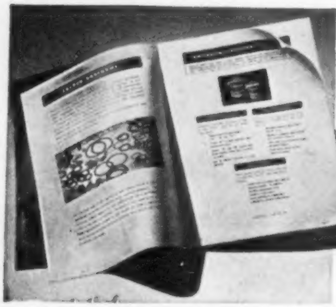

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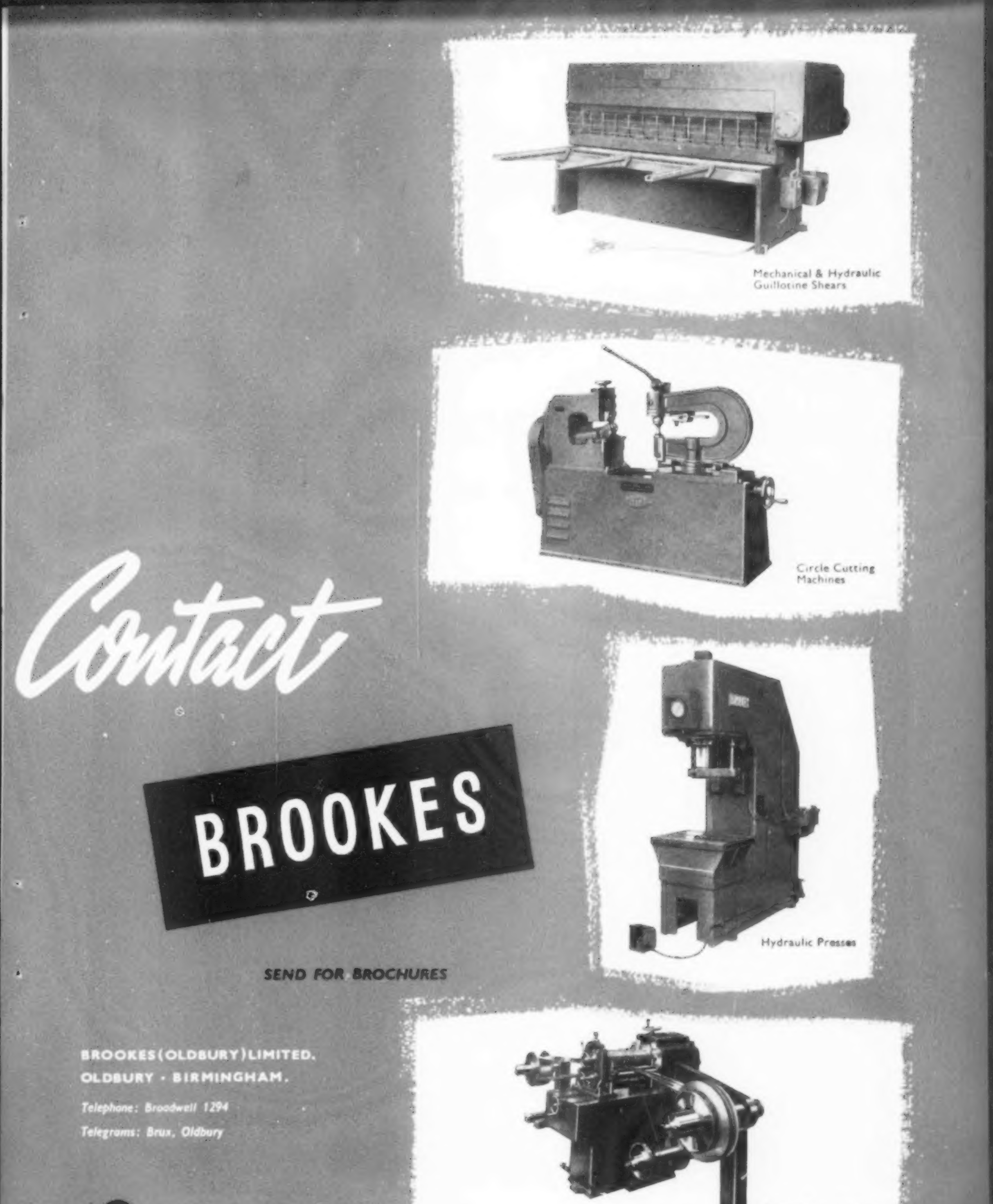
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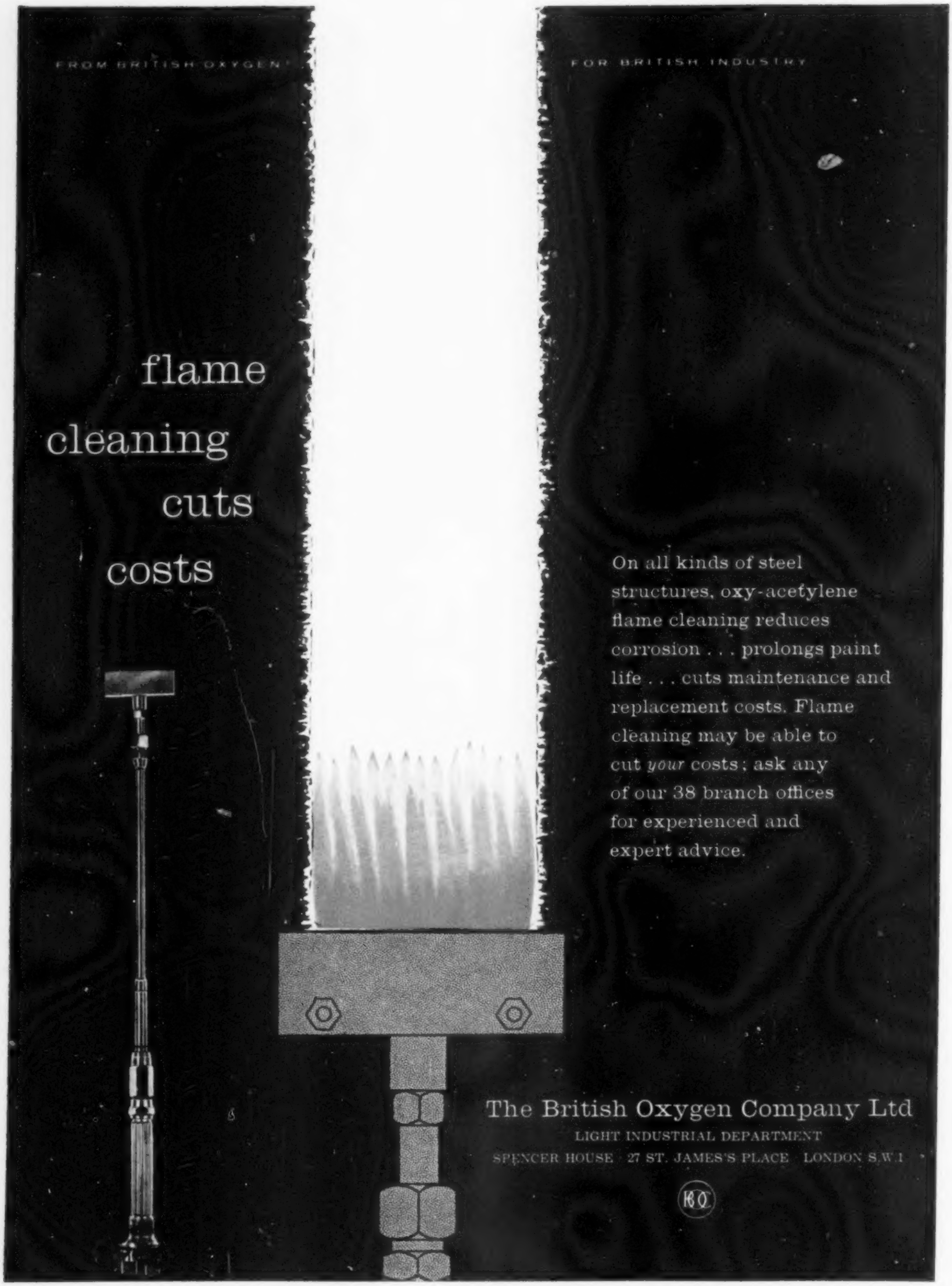
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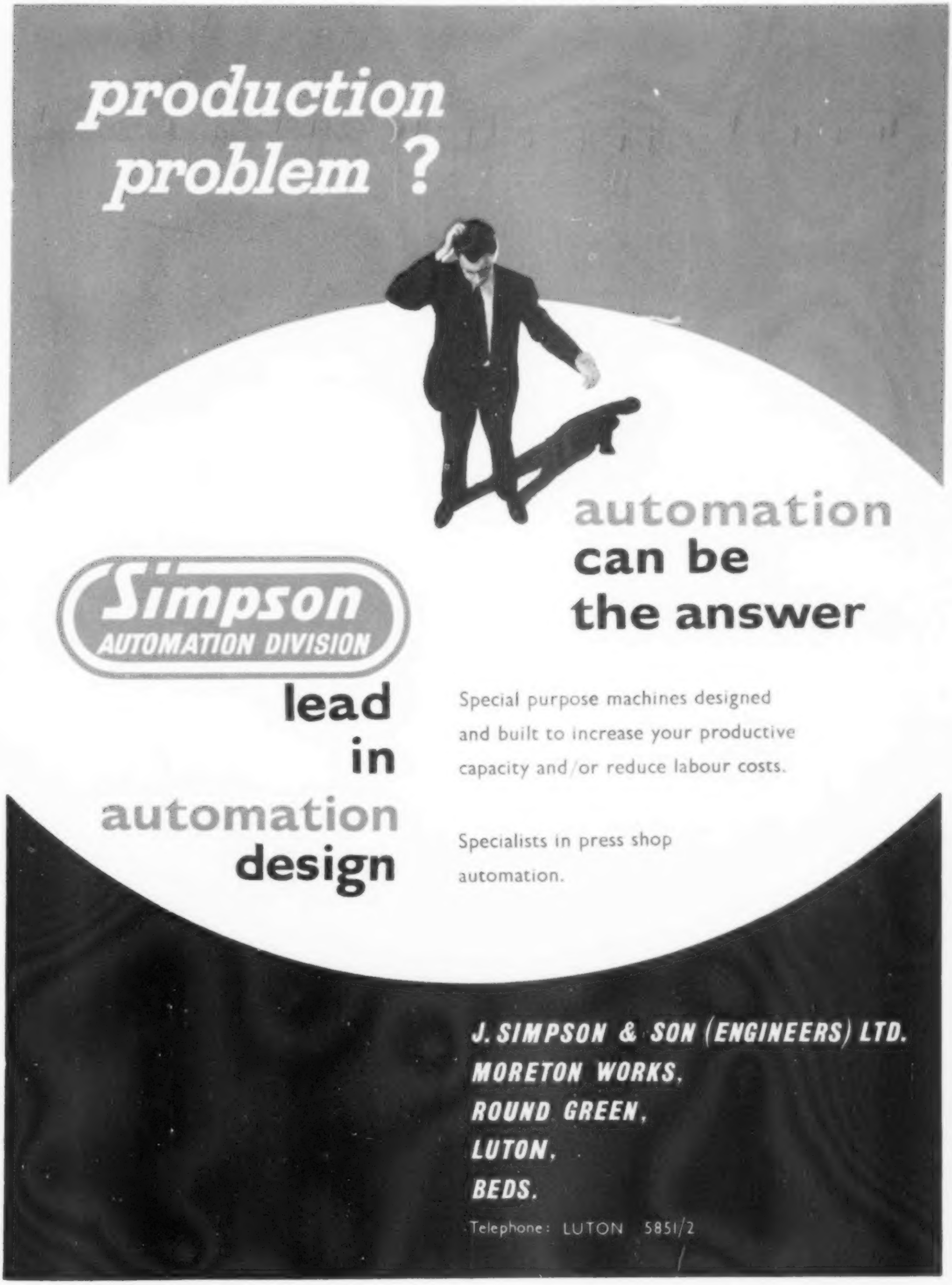

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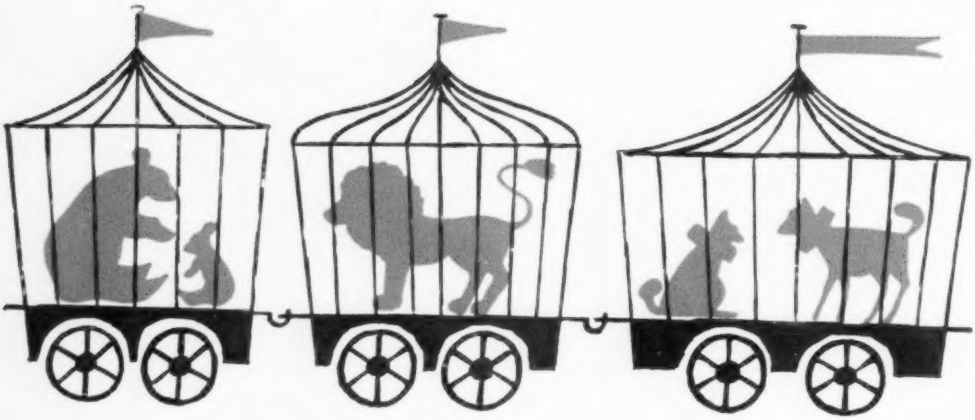

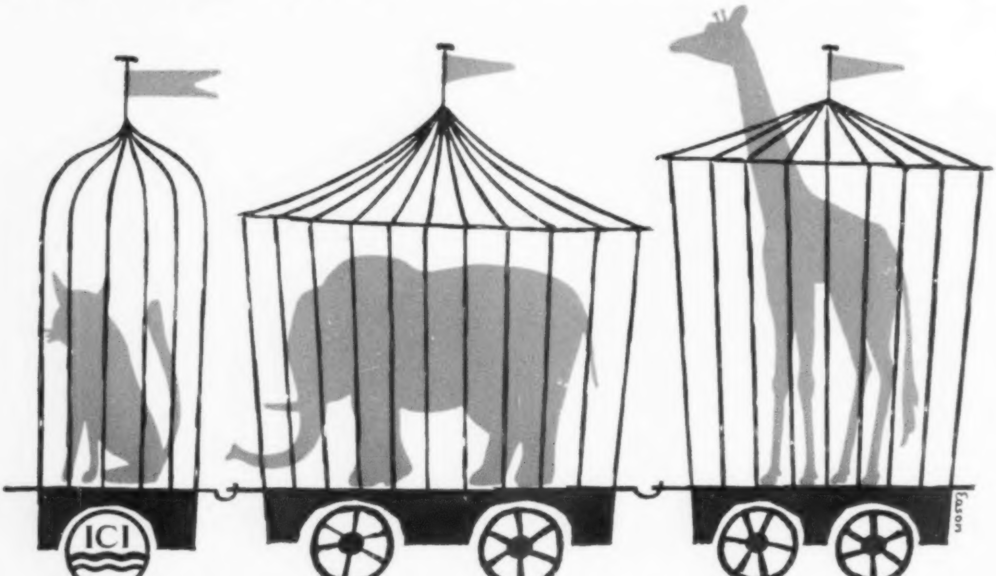

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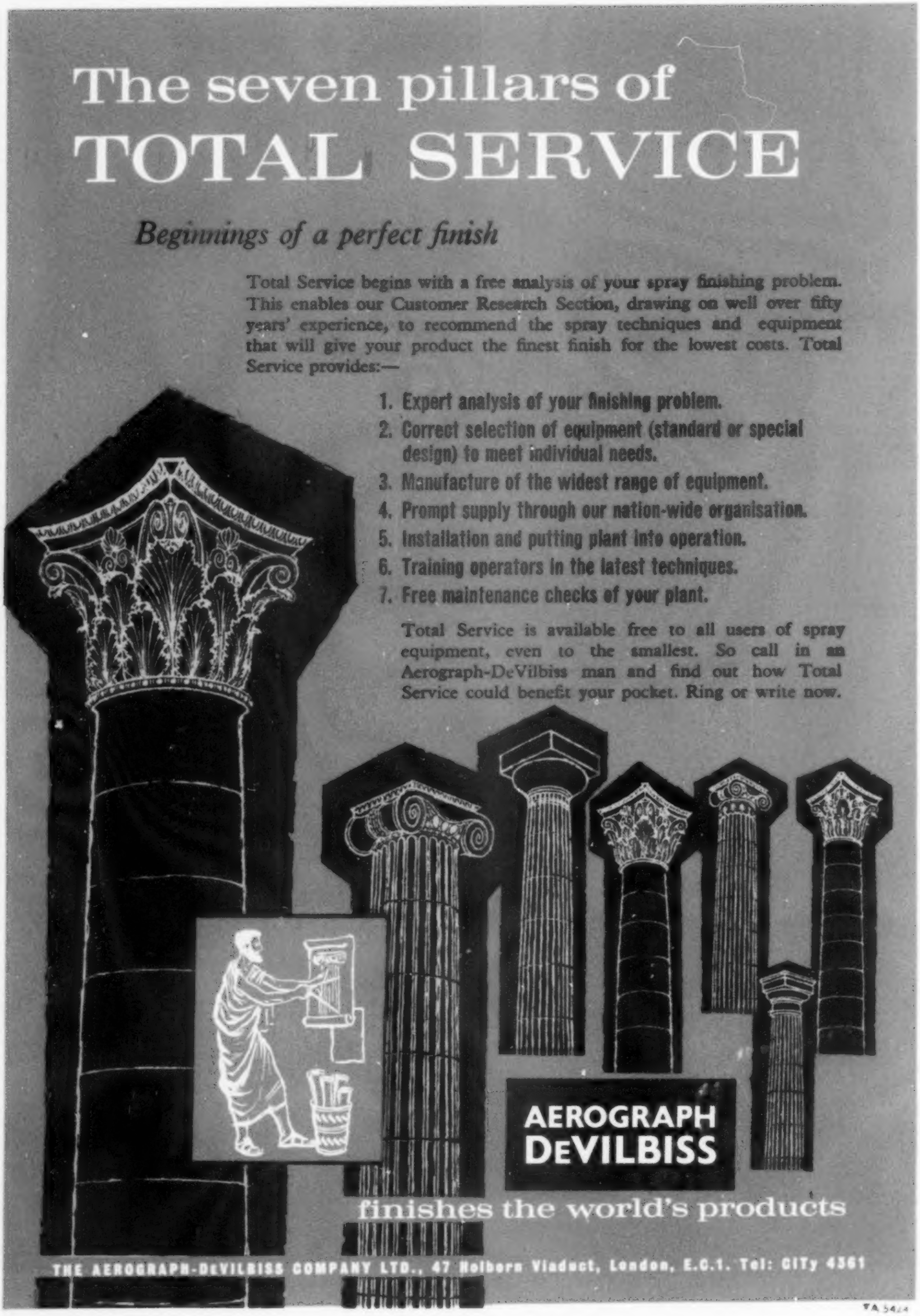
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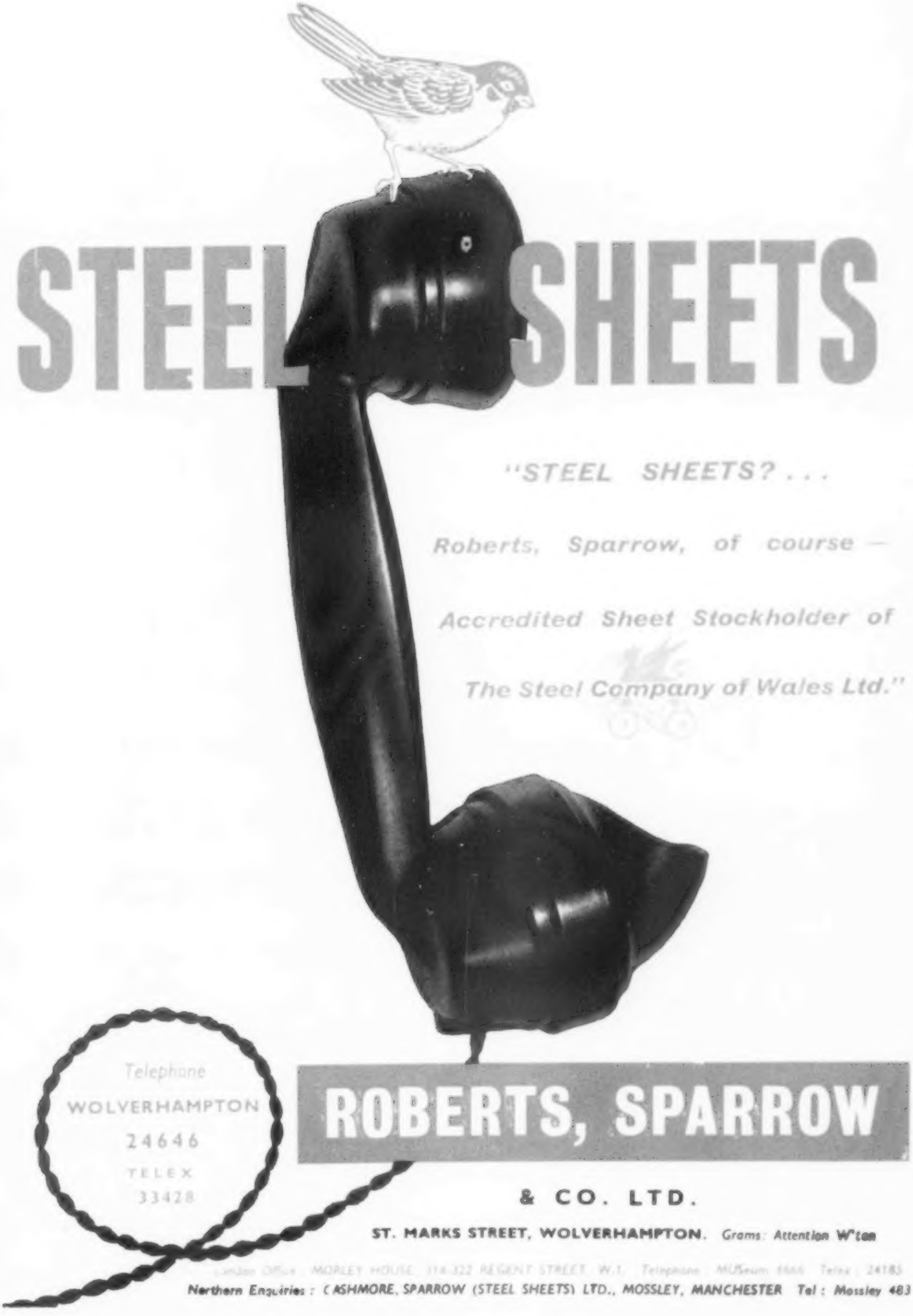

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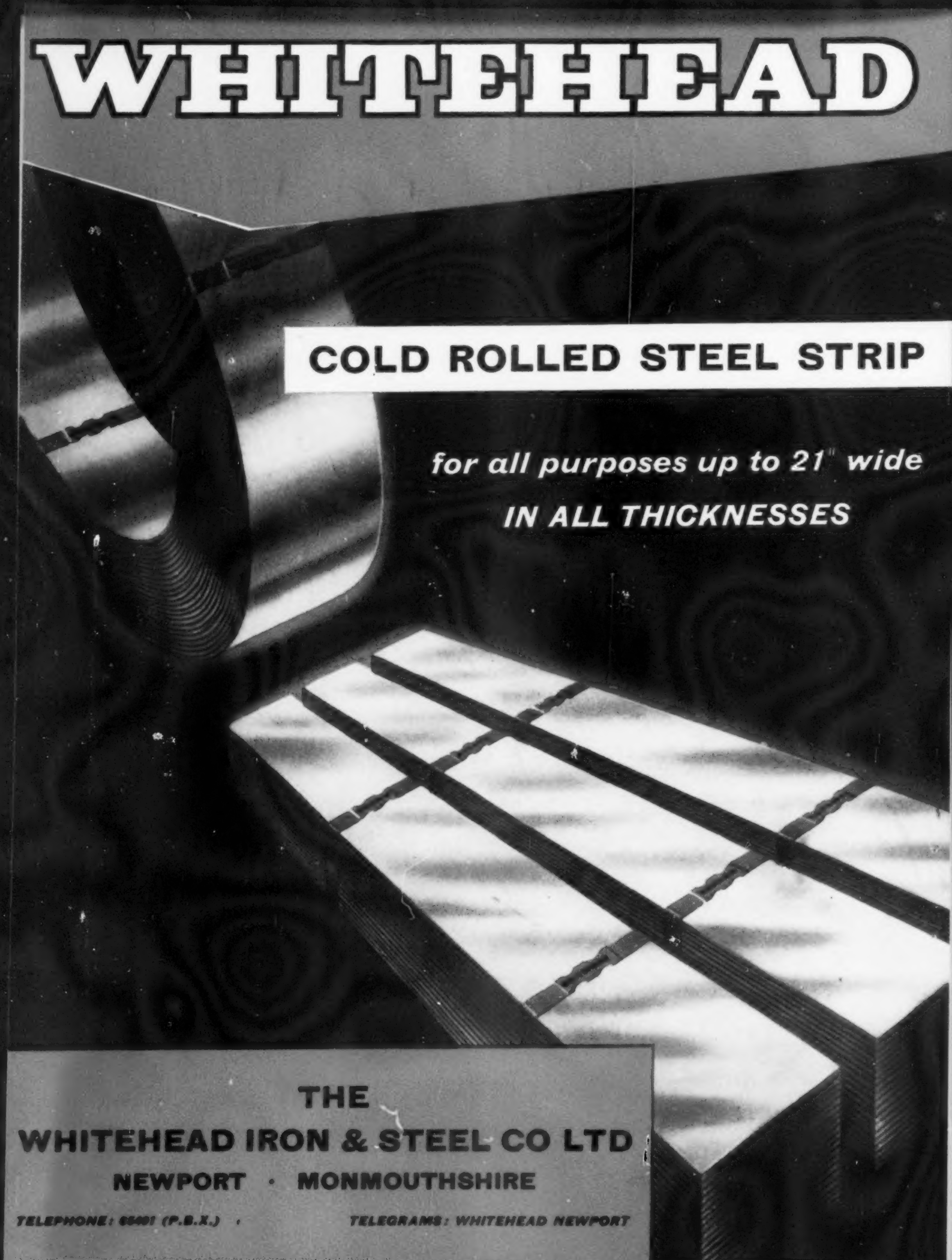
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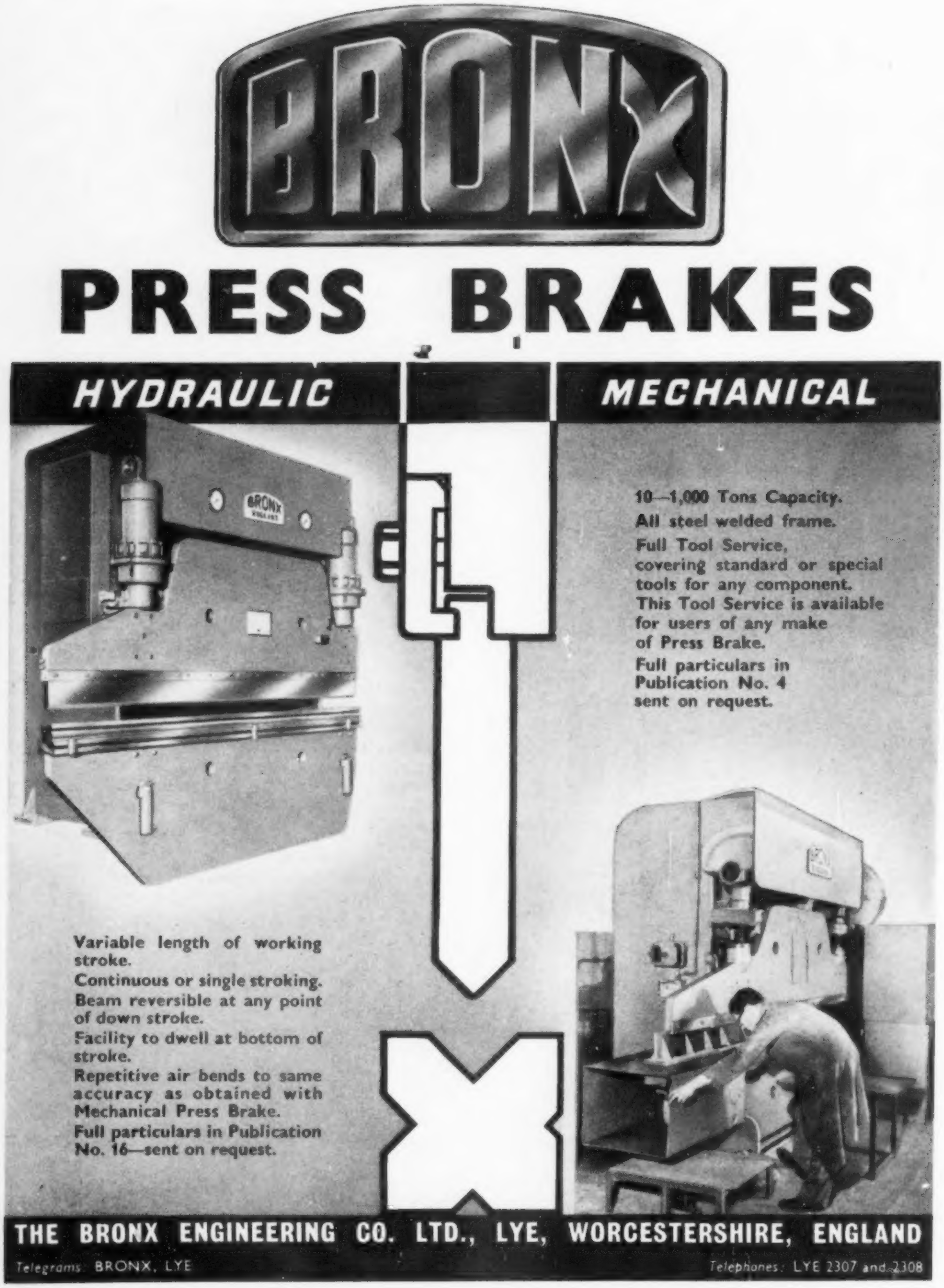
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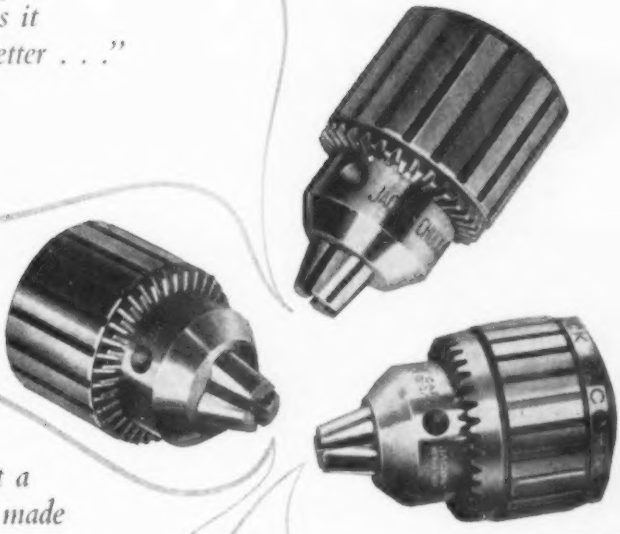

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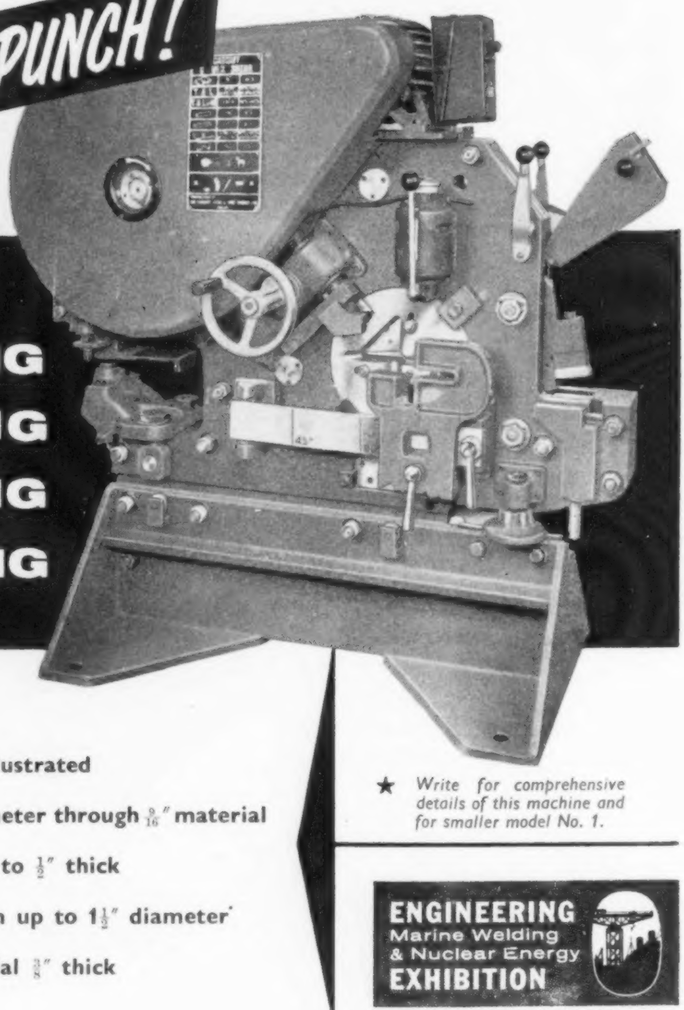

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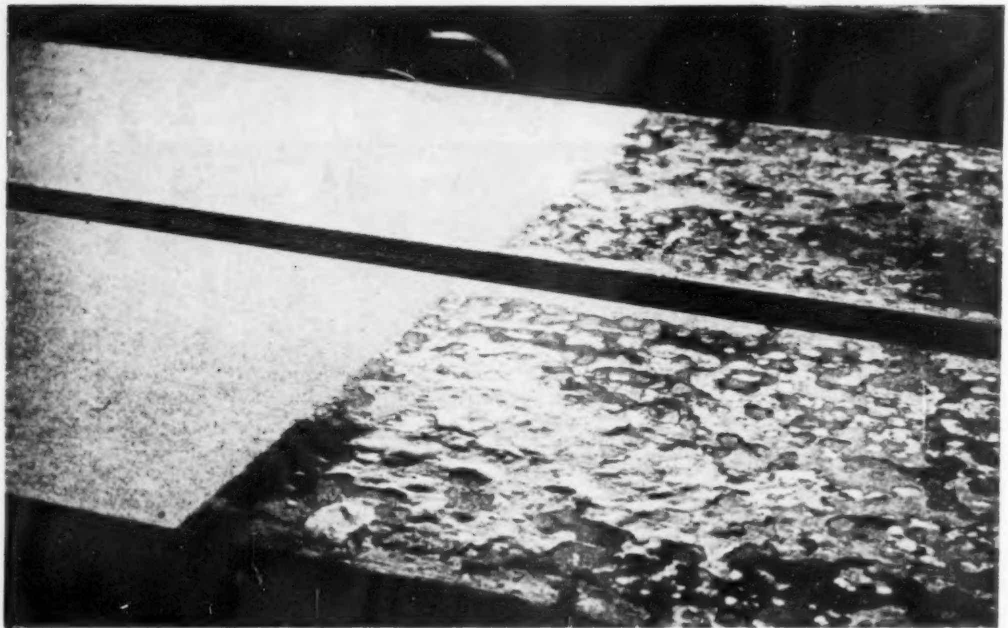

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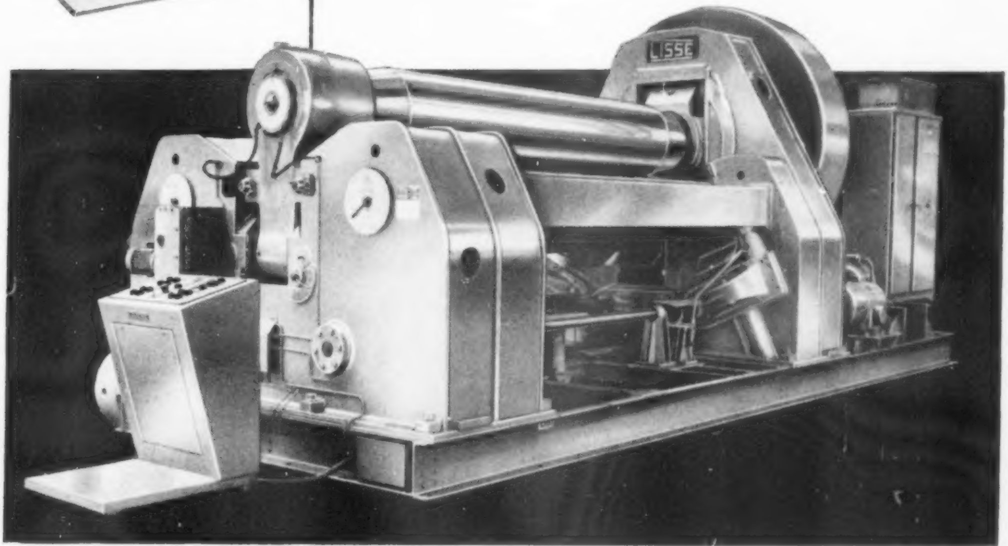

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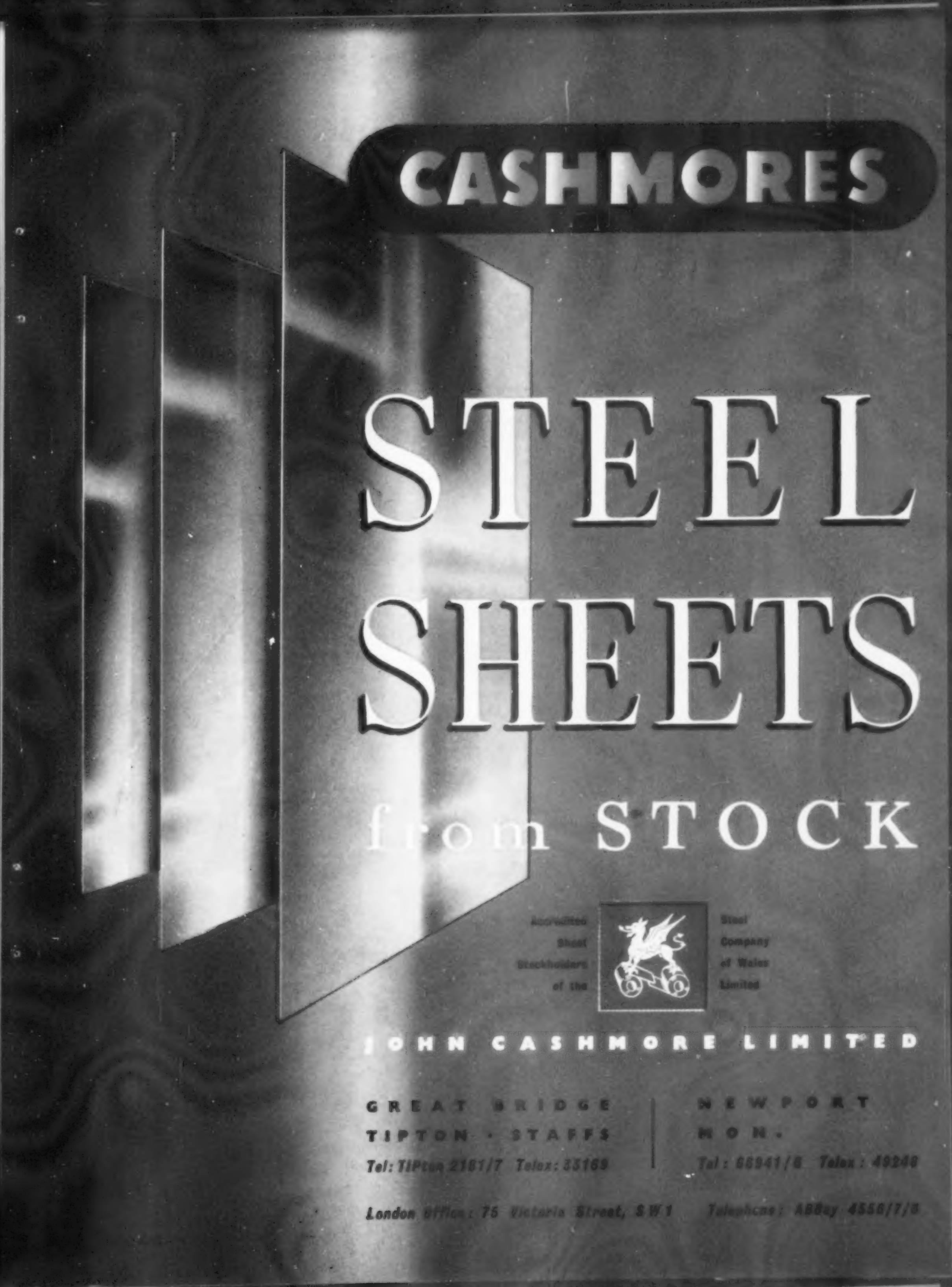
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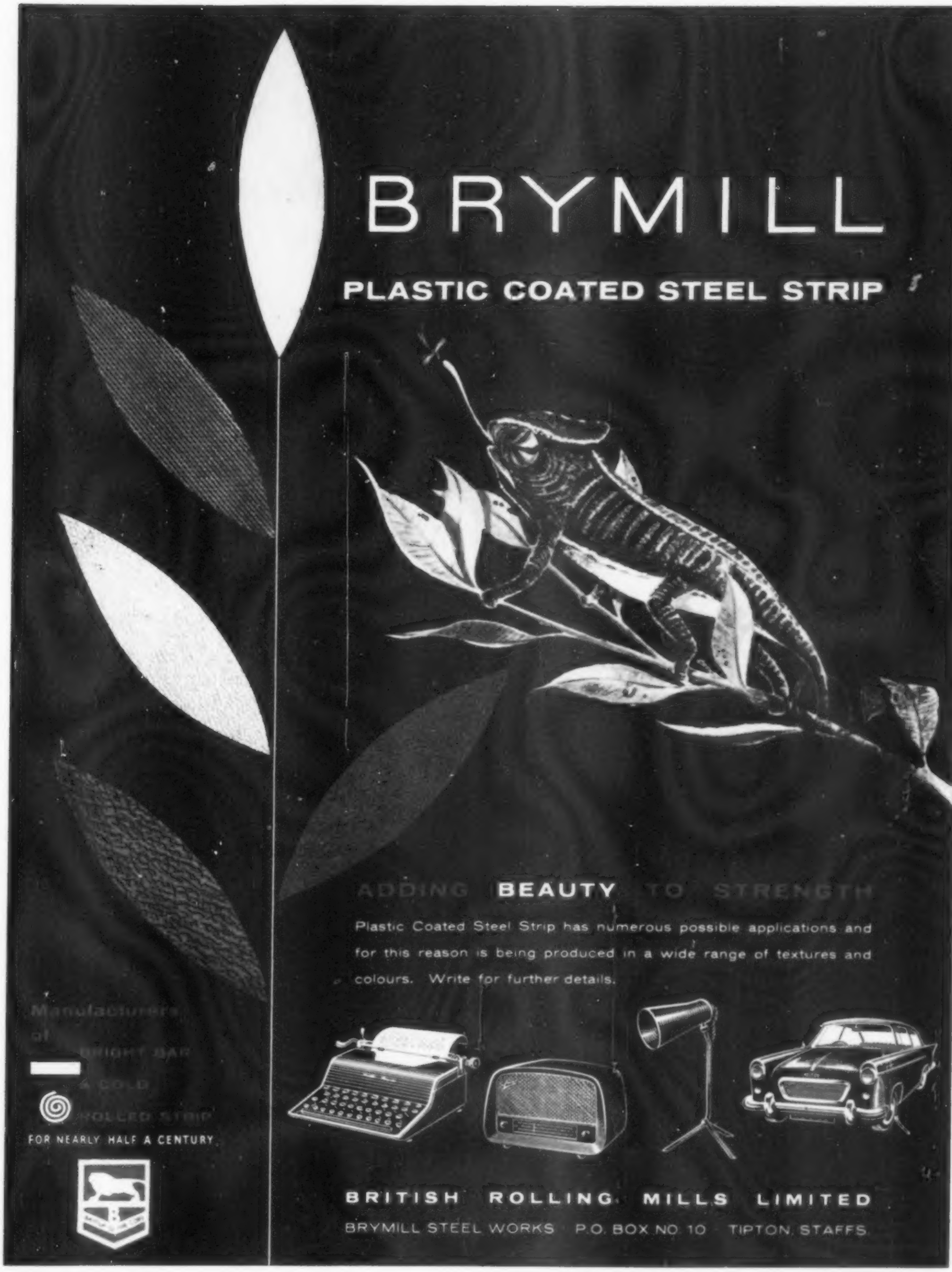
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Depuis plus de 50 ans la Société John Thompson fabrique les châssis pour Rolls Royce Ltd. Cet article décrit la fabrication de certains organes et l'assemblage du châssis servant actuellement aux voitures Bentley Contientale et Rolls Royce Phantom V. Quoique les procédés techniques soient semblables à ceux employés pour les châssis Rover, dont il a été question dans un article précédent, la majorité des opérations de soudage des sous-chassis latéraux, se faisant par soudage à l'arc à électrode de carbure, certaines caractéristiques de la production sont intéressantes du fait du niveau élevé de la qualité exigée par Rolls Royce.

Refoulage a froid de petites pieces symetriques et asymetriques .. .. page 335

Par le Prof. Dr.-Ing. O. May

En opposition avec tous les autres mémoires au sujet de refoulage à froid de l'acier, présentés à la Conférence de l'Institute of Sheet Metal Engineering (Institut des Ingénieurs Toliers), ce mémoire et le débat qui a suivi sa présentation traitent de la production de pièces de très petites dimensions, telles que les tirettes de montres, les pièces d'appareils photographiques, de machines à calculer, etc. Il traite également d'une presse spéciale à fluage lent qui, à une même vitesse de fonctionnement et une même course qu'une presse excentrique, donne une vitesse de piston dans la zone même du travail, de nombreuses fois plus lente qu'une machine excentrique équivalente. Cette allure lente est d'une importance considérable dans la production des petites pièces dont traite ce mémoire.

Recuite des ressorts de compression — examen du procédé, son emploi actuel et dans l'avenir .. .. page 341

Par V. J. Gibbons

Le procédé de la recuite des ressorts de compression a été développé par la Lee-Wilson Engineering Co. aux Etats-Unis et l'auteur est le directeur général de la Lee-Wilson Engineering, S.A., Suisse. Cet article, basé sur un mémoire présenté récemment à la Newport & District Metallurgical

(*Suite page* 380)

ZUSAMMENFASSUNGEN DER HAUPTARTIKEL

Produktionsverfahren im werk beacon der John Thompson Motor Pressings Ltd.—5 Seite 320

Seit mehr als 50 Jahren stellt die Firma John Thompson Fahrgestelle für die Rolls Royce Ltd. her. Der vorliegende Teil beschreibt die Herstellung von Einzelteilen für die Fahrgestelle des Bentley Continental und des Rolls Royce Phantom V und deren Zusammenbau. Obgleich die Verfahren den in einem vorangehenden Teil beschriebenen, bei den Rahmen des Rover angewendeten insofern ähnlich sind, als die Schweißung der Seitenrahmen usw. hauptsächlich automatisch durch Kohlelichtbogen erfolgt, sind gewisse Arbeitsvorgänge wegen des von Rolls Royce verlangten hohen Qualitätsniveaus doch von Interesse.

Kaltextrusion kleiner symmetrischer und unsymmetrischer teile .. Seite 335

Von Prof. Dr.-Ing. O. May

Zum Unterschied von allen anderen auf der Konferenz des Institute of Sheet Metal Engineering gehaltenen Vorträge über das Kalt-Strangpressen von Stahl befaßten sich dieser Vortrag und die anschließende Diskussion mit der Herstellung sehr kleiner Teile für Uhren, Kameras, Rechenmaschinen usw. Es wird auch eine besondere "Langsamfluß"-Presse erwähnt, die bei gleicher Betriebsgeschwindigkeit und gleichem Hub wie eine Exzenterpresse eine Kolbengeschwindigkeit in der eigentlichen Arbeitszone hat, die um ein Vielfaches kleiner ist als die der entsprechenden Exzentermaschine. Eine solche langsame Bewegung ist von großer Bedeutung für die Herstellung der erwähnten kleinen Teile.

Durchlaufglühen—ein überblick über das verfahren und Gegenwärtigen und zukünftigen anwendungsgebiete Seite 341

Von V. J. Gibbons

Das Durchlaufglühverfahren wurde bei der Lee-Wilson Engineering Co. Inc. in den U.S.A. entwickelt. Der Verfasser ist Generaldirektor der Lee-Wilson Engineering S.A. in der Schweiz. Der den Inhalt eines kürzlich vor der Newport and District Metallurgical Society gehal-

(*Forts. S.* 380)

RÉSUMENES DE LOS ARTICULOS PRINCIPALES

Procedimiento de producción en los Talleres Beacon de la John Thompson Motor Pressings Ltd.—5 .. página 320

La John Thompson lleva más de 50 años produciendo chasis para la Rolls Royce Ltd. Este episodio describe la producción de algunos de los componentes para y el armado de los chasis que se emplean actualmente para los Bentley Continental y los Rolls Royce Phantom V. Aun cuando las técnicas son parecidas a las empleadas en la producción de los bastidores para los coches Rover y que se han descrito en un episodio anterior, ya que la mayor parte de la soldadura de los marcos laterales, etc., se efectua por el sistema de soldadura automática al arco de carbón, ciertas características de la producción revisten interés debido a la alta calidad que exige la Rolls Royce.

La extrusion en frio de elementos pequeños simetricos y asimetricos .. página 335

Por El Prof. Dr.-Ing. O. May

A diferencia de todos los demás trabajos presentados durante la Conferencia del Instituto de Ingeniería de la Chapa Metálica, este y la discusion de que fué seguida su presentación tratan de la producción de elementos muy pequeños tales como 'tirets' para relojes, máquinas fotográficas y máquinas calculadoras, etc. También se hace referencia a una prensa especial de "flujo lento" que, con la misma velocidad de trabajo y el mismo recorrido de una prensa excéntrica tiene una velocidad de ariete en la zona de trabajo misma mucho más lenta que la de la máquina excéntrica equivalente. Esta velocidad reducida es de suma importancia en la producción de los elementos pequeños de que se trata.

Recocido por inducido abierto — Un estudio del procedimiento y de sus aplicaciones actuales y futuras página 341

Por V. J. Gibbons

El procedimiento del recocido por inducido abierto fué un perfeccionamiento de la Lee-Wilson Engineering Co. Inc. de los EE. UU. de A. y el autor es el director general de la Lee-Wilson Engineering S.A., de Suiza. Este articulo que se basa sobre una ponencia presentada recientemente ante la Newport and District Metallurgical Society (Sociedad Metalúrgica de Newport y su Distrito),

(*Continuará en p.* 380)

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VARIATIONS ON THE THEME

WE make no apology for referring yet again to the ever-present problems of our export trade, particularly in the light of the Government's recently-published economic survey. Some will no doubt groan and say that this is the old theme again, but our purpose to-day is to compose some variations on this old theme. If, to make a musical metaphor, the harmonies in these variations are more discordant than usual then at least their jarring notes will perhaps draw attention to the main theme on which they are based.

One has only to read the speeches of many industrialists to-day to realize that " exportese " is in the forefront of the thoughts of all those who really appreciate the fact that our future prosperity depends entirely on the increasing sale of our goods overseas. We notice with pleasure, therefore, that the smaller exporter, with an export turnover of less than £10,000 per annum is now eligible for the special government insurance which is aimed to make a firm's export earnings *sure* in the simplest possible way, and we are also delighted to see that with this new system, introduced recently by the Export Credits Guarantee Corporation, paperwork is reduced to a minimum. This really is a step forward as there is no doubt that paperwork has been one of the millstones round the neck of anyone who is anxious to send his goods to markets abroad.

But even though we must not lose sight of the fact that we must produce efficiently the right goods at the right price and at the right time, even more must we be conscious of the fact that all goods have to be sold and in our view there are far too few salesmen " on the road " abroad in comparison with other countries. One has only to consider the sales drives of continental firms in the U.K. to obtain some measure of the competition we are facing. Constant personal contact does matter, for so many sales are generally effected between a buyer and a salesman.

But salesmen for service abroad should be specially trained and at the end of their training they should be given maximum status, for the higher the level of man that can be sent overseas the more effective he is likely to be. Salesmen should know the feelings, speak the language and appreciate the requirements and aspirations of the countries to whom they are selling. In addition, a salesman should also sell Britain as a country, as all too seldom do we press home our " firsts " in the scientific and industrial spheres and seldom do we say how efficient most of our industry is !

The salesman then has plenty of background material to use in his efforts to influence prospective buyers abroad, but all too frequently our story is concerned only with our problems and not our achievements. In a recent speech, Sir William McFadzean, the retiring president of the F.B.I., speaking about exports, said that 1960 would be labelled " The Year of Exhortation." Believing that more exhortation is not too much we add our words to Sir William's hope that 1961 will be " The Year of Action."

Production Procedures at the Beacon Works of

JOHN THOMPSON MOTOR PRESSINGS Ltd.

Production of Rolls-Royce and Bentley Chassis

AMONG the many cars for which John Thompsons make chassis, few, if any, have the reputation, built up over half a century of motoring, of Rolls-Royce. Exceptional quality of workmanship, as well as use of materials, characterize both the Bentley and Rolls-Royce cars, produced to one essentially basic design at Crewe.

John Thompson Motor Pressings Ltd., have been the suppliers of chassis frames for these world-renowned cars for over fifty years. During that time craftsmen at Wolverhampton have maintained and improved their standards of quality at much the same rate as that of Rolls-Royce and are thus able to provide the " backbone " to what is surely Britain's finest ambassador of quality motoring.

Chassis frames produced at Wolverhampton are incorporated on the Bentley, the Bentley Continental, the Rolls-Royce Phantom V, and a special chassis is made for the long-wheel-based saloon. All of them are of welded construction.

The main frame members constitute a pressed box-section welded by the carbon-arc process and are crossbraced centrally with cruciform members of similar section. They are completely sealed and pressure tested to guard against corrosion.

General Assembly Sequence

Assembly of the chassis frame follows normal engineering practice in that sub-assemblies are first produced which are gradually fed into the main assembly line at appropriate stages. The demand for Rolls-Royce and Bentley cars is such that chassis fabrication is undertaken only to meet specific demand requirements. The assembly line is therefore, of necessity, continuous but not producing chassis all the time. This enables that extra attention to be given to the chassis when they are being produced, necessary to meet the high specification standards demanded by Rolls-Royce, and also allows flexibility in the use of equipment in the shop which is continually producing chassis of other makes.

One obvious example of careful planning procedures in the shop is that the side members of the frame, which are of pressed box section, two U-sections welded together, are welded in the same type carbon-arc machine used on the Rover chassis.*

Before the side members are carbon-arc welded together, angle stiffeners are spot welded to the front end of each side member by a single-spot Aseavets 60-kVA machine, and flat plate stiffeners

*See *Sheet Metal Industries*, 1960, November, page 798.

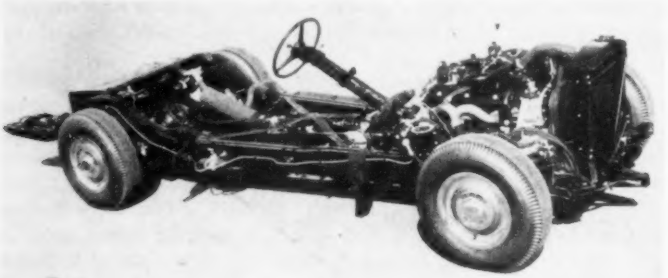


Fig. 91.—Bentley S.2. chassis showing general arrangement of road equipment

5

(Series continued from page 222, March, 1961)

spot welded to the rear end of each side member by a twin-spot Aseavets 60-kVA machine. The spot welds are produced in two rows, some two inches apart with a half-pitch stagger between the rows.

This operation forms the beginning of the main assembly sequence and from here on other sub-assemblies are fed into the line.

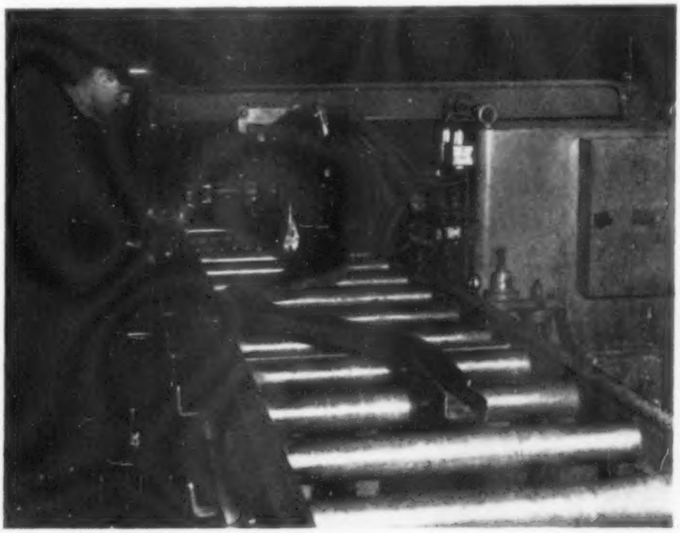
The carbon-arc machine was developed by John Thompsons themselves, but the welding head was designed after considerable experimental work by Philips Electrical Ltd. The two halves of each side member are first placed in a jig and tack welded every six to eight inches along the whole length, top and bottom. The jig is then fitted into the machine. The position of the welding head is fixed, and air-operated rollers, in conjunction with a follower in contact with the top of the member, keep the weld seam in constant alignment with the electrode for the first two-thirds of its travel. The jig is reversed in the machine and the underside welded in a similar manner.

Following this studs are welded onto each side member by a Cycarc Type 3 machine. The studs, made of Fortiweld steel, are fitted with a consumable insulator and projection welded onto the side members, after which part of the stud can be broken off. These studs are used for sundry attachments, fitted at a later stage, such as hydraulic piping and wiring.

The side members are now ready to meet other sub-assemblies.

Fig. 92 (above).—The eight-cylinder Bentley S.2. saloon

Fig. 93 (right).—Flat plate stiffeners are spot welded to rear end of side members with an Aseavets twin-spot 60-kVA machine



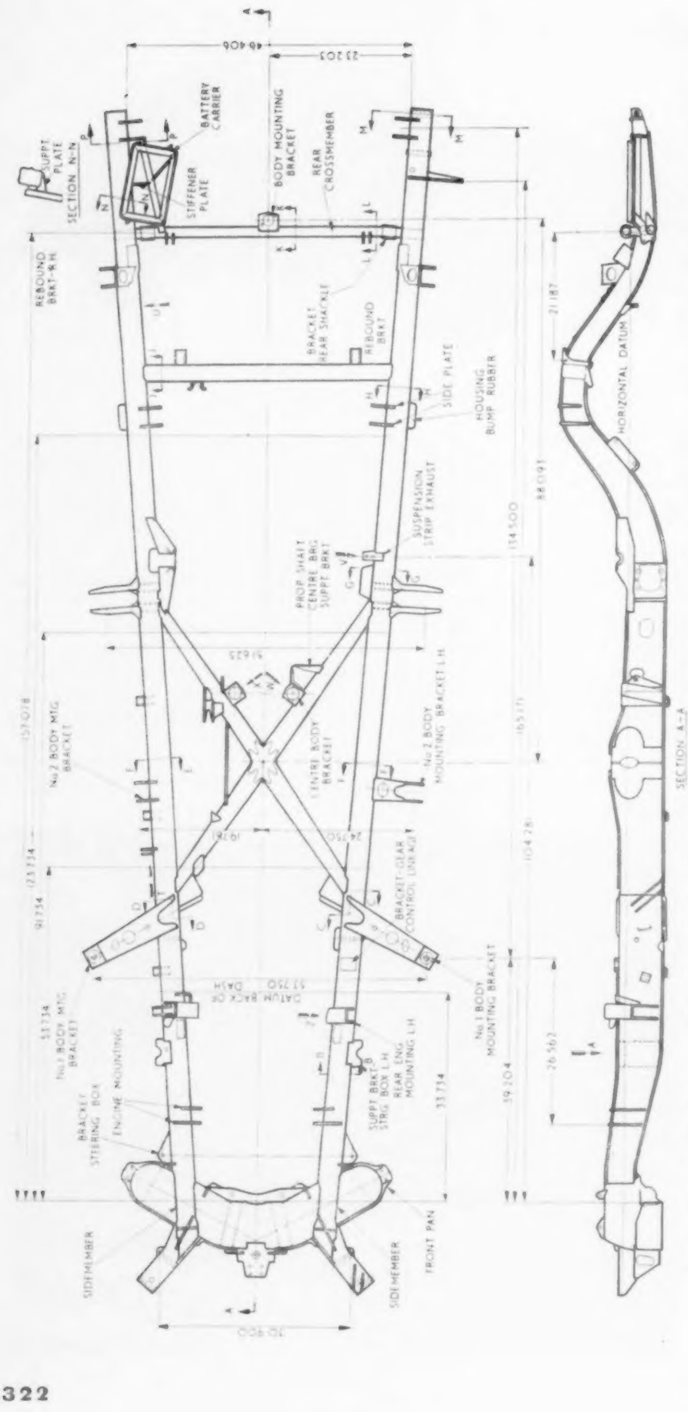


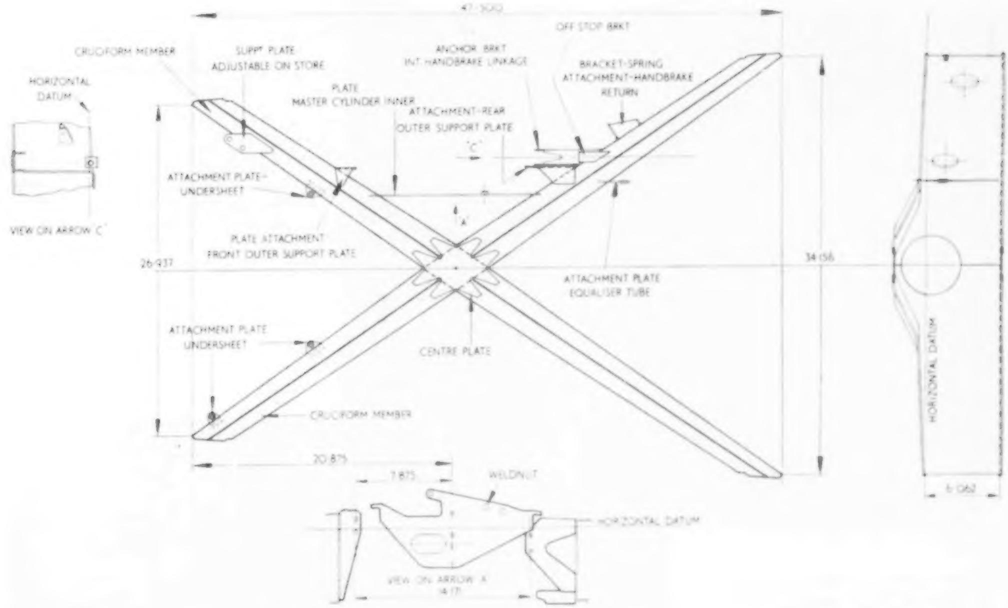
Fig. 94.—General assembly details of Rolls-Royce chassis frame

The crossbrace assembly gives the chassis its extra torsional stiffness and is manufactured in a similar way and from material with the same mechanical properties as the side members. Its design has a four star arrangement, each prong of the star being built up from an inner and an outer pressed-steel section which are carbon-arc welded along the top and bottom seams. The four prongs are then hand welded together at the centre intersection and a gusset plate attached. Several stiffening members and brackets are attached to the crossbrace, such as a support plate for the brake master cylinder, before the assembly is transferred to the main assembly line.

The side members and the crossbrace form the main bulk items assembled outside the main sequence although numerous other small sub-assemblies, for instance the centre and outer front pan assembly which eventually carries the independent front suspension units and steering, are also being produced.

The side members are placed in a welding fixture and the crossbrace and other cross members fitted and part welded to them. The welding fixture is designed to rotate and provides easy access to all parts of the frame. Most of the smaller sub-assemblies are temporarily attached in this fixture, including all the body-mounting brackets, battery carrier and spring-mounting brackets.

The part-welded frame is then mounted in a jigging fixture where all holes and pick-up points are checked for dimensional accuracy before the

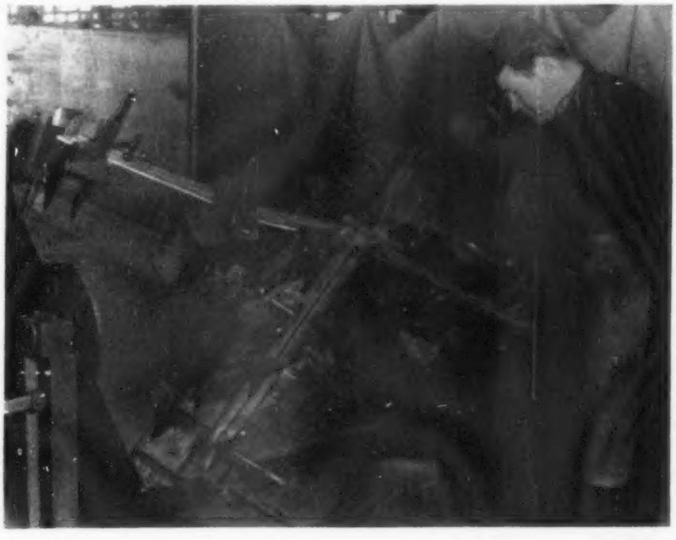


final welding operation. Here again the jigging fixture has been designed in the same way as the welding fixture and rotates freely about points at the centre of either end. Following this dimensional check all part-welded assemblies are finish welded by hand and the frame transferred to another rotating jig where all holes are opened up to size and all the main drilling operations completed. There are approximately twenty-four holes drilled while the frame is in the jig, twenty in the front end mainly for the attachment of suspension and steering items and four in the rear end.

The next operation is essentially one which illustrates the high standard set by Rolls-Royce for their chassis. As a precaution against water entering the side members which would cause

Fig. 95 (above).—General assembly of crossbrace shows four star formation with centre gusset plate

Fig. 96 (right).—Assembly jig for cross brace where the four prongs are hand welded together having first been carbon-arc welded top and bottom



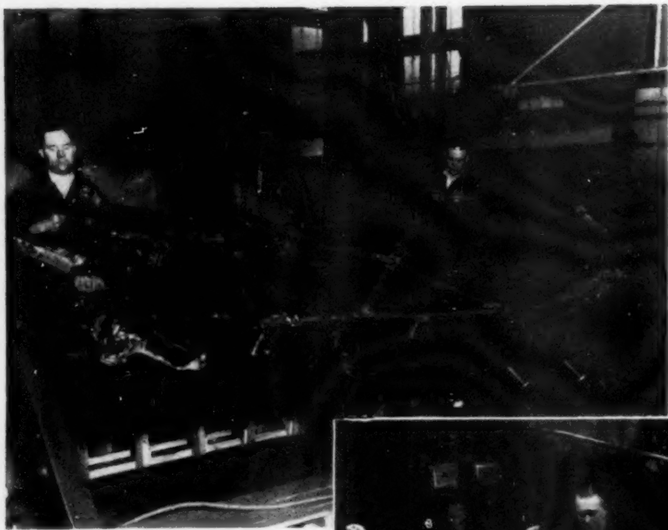
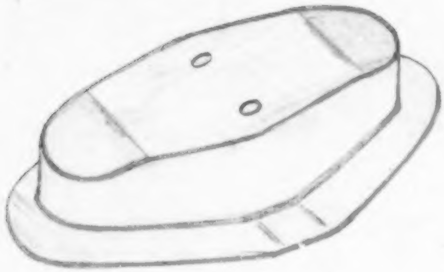


Fig. 97 (left).—Frame mounted in drilling jig where all holes are opened up to size and all main drilling operations completed. Here the front-suspension holes are being drilled

Fig. 98 (right).—Part-welded frame mounted in rotatable jigging fixture where all holes and pick-up points are checked for dimensional accuracy prior to final welding operations

Fig. 99 (left).—Front panel assembly jig where stiffeners and brackets are attached



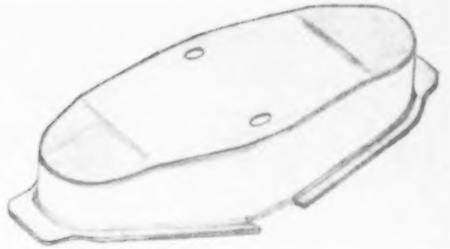
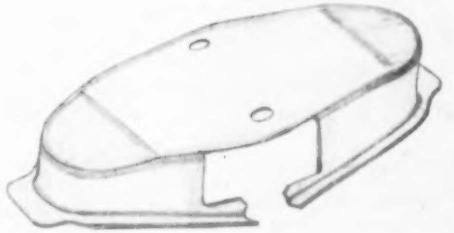


Fig. 100 (*above*).—*Front pan outer section after first and second drawing operations*

Fig. 101 (*above right*).—*Base clipped*

Fig. 102 (*right*).—*Sides and flange clipped*

Fig. 103 (*below*).—*Item parted across the centre to form the left-hand and right-hand assemblies*



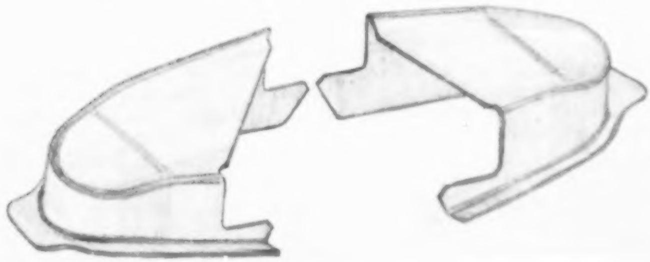
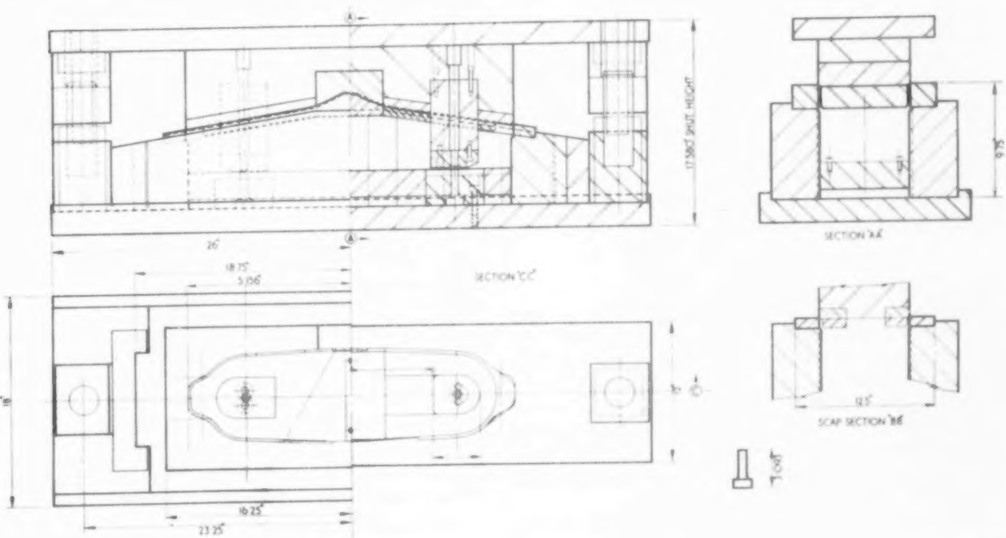


Fig. 104 (*below*).—*Clipping tool for front pan outer section. This operation is the last of three ganged tools in a 750-ton press*



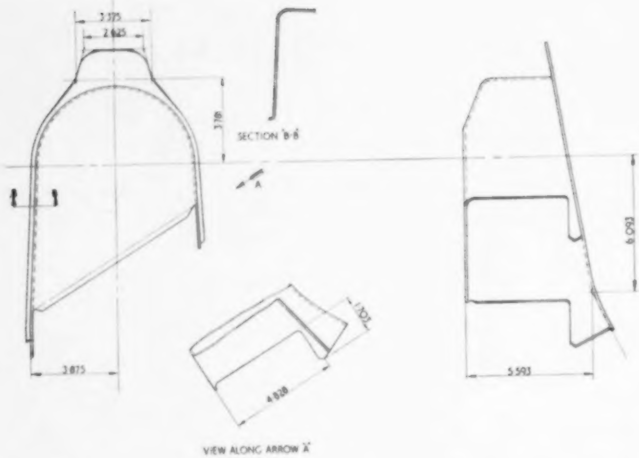


Fig. 105.—*General arrangement of front pan outer section, showing that difficulty in production would be experienced if both parts were not made at the same time*

corrosion and do irreparable structural damage to the frame, the specification demands that the carbon-arc welds on the top and bottom seams of the side members should be capable of withstanding 10 lb. per sq. in. without leakage.

The surface of the weld is first prepared by wire brushing and then painted with Modaply, a solution which indicates, in much the same way as ordinary soap solution, the position of any leaks in the weld. Air is then blown into the front end of each side member to a pressure of 10 lb. per sq. in. and the top and bottom seams checked for leaks. Equipment is available on the spot should any part of the weld need attention. The Modaply compound also acts as a derusting fluid, which helps the final derusting and degreasing operation, following the pressure test, before the frame is enamelled.

The enamelling plant was manufactured by Carrier Engineering Co. Ltd., and is used for all chassis produced at John Thompsons. Its operation is straightforward. The frame is fixed onto an overhead conveyor which lowers it into a bath of enamel where it remains for a few seconds. It is then lifted out of the bath and starts its conveyorized journey through the stoving plant.

Component Production

Side Members

The side members of any chassis play a major role in the strength of the frame since they take the greater part of all the lateral and transverse bending loads and, suitably cross-braced, give the frame much of its torsional stiffness. The design and manufacture of the side members is therefore critical and every effort is made to ensure that their design is in keeping with the unparallelled reputation of the car of which they are part.

They are made from 16-s.w.g. EN2B sheet, pressed in two U-shaped sections which are later welded together to form one side member. The rear end of the member is upswept to clear the rear axle and rear spring attachments and have a variable section along their length.

The sequence of operations in their production is blank and pierce in a 2,000-ton Clearing press, form in the same press after which they are clipped in pairs.

Both halves of each side member have stiffeners spot welded onto them. At the front end the stiffeners are of angle form, manufactured from 16-s.w.g. sheet. It is found that by pressing the angle stiffeners in pairs and parting them to give two handed angle items, a much smaller corner radius may be obtained, which ensures closer contact between the stiffener and the side member when spot welded together. The rear stiffeners are 16-s.w.g. flat plate which is cropped to the required length and spot welded on the inside of the side member.

Crossbrace

The crossbrace gives the frame strength in both bending and torsion and is attached to the side members approximately in the middle where the frame is at its weakest. The cruciform has a four star configuration of the same section as the side members at the centre.

All the components that make up the crossbrace, except for the gusset plate which is 14-s.w.g. sheet, are made from 16-s.w.g. sheet. There are in all eight separate U-shape pressings which make up the star of the brace when welded together:

Left-hand Inner Rear. Made from 16-s.w.g. EN2B sheet. The sheet is split then blanked, formed and clipped in an 800-ton press.

Left-hand Outer Rear. Made from the same

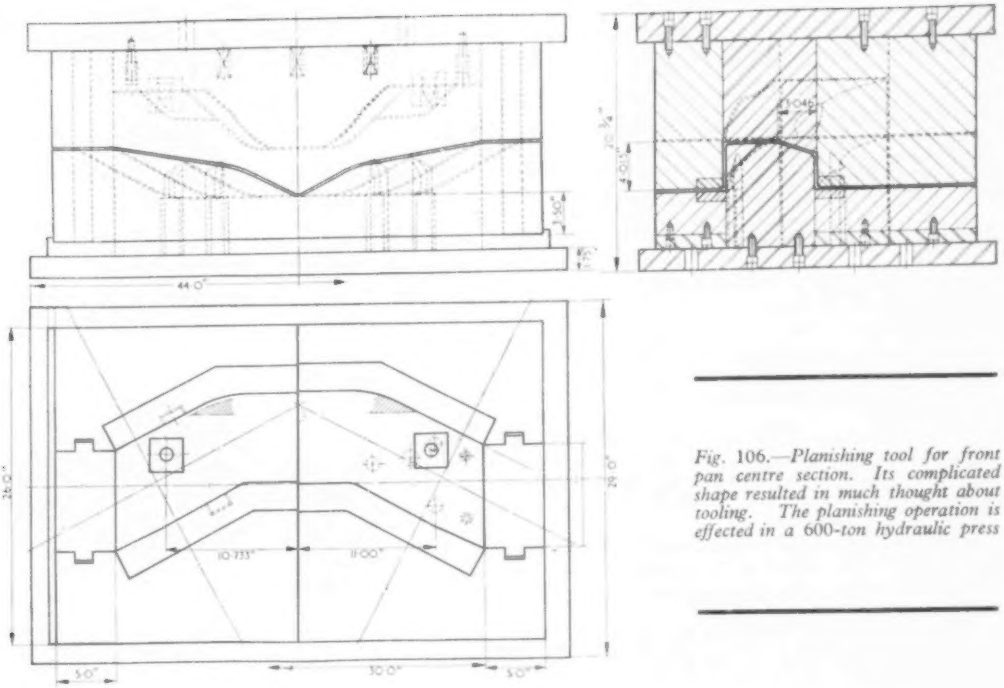
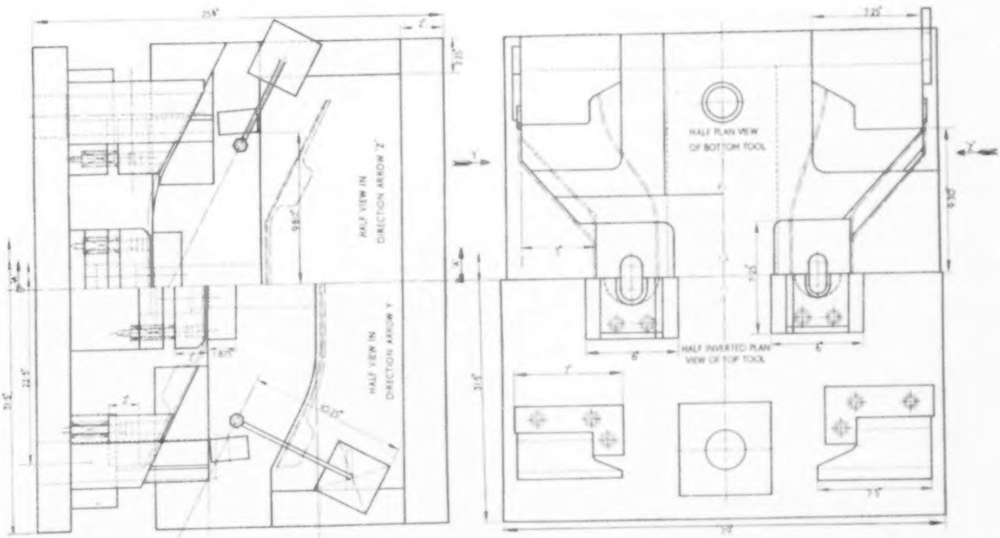


Fig. 106.—Planishing tool for front pan centre section. Its complicated shape resulted in much thought about tooling. The planishing operation is effected in a 600-ton hydraulic press

Fig. 107 (below).—Crop and piercing tool for front pan centre section, which crops and pierces the flange



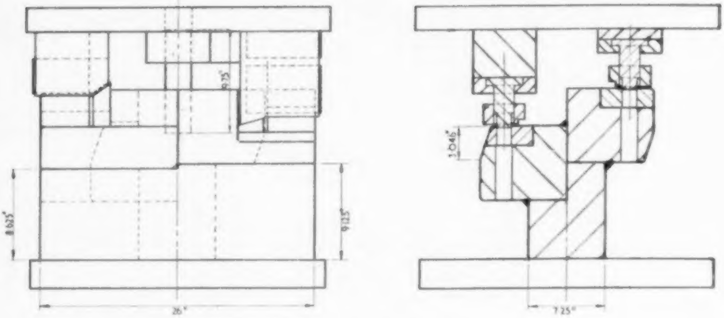


Fig. 108.—*Clipping tool for trimming the base of the front pan centre section before final pressing*

material as the inner item: blanked, formed and clipped in the 800-ton press but has an additional cropping operation, in a 30-ton press.

Left-hand Outer Forward. Manufactured in exactly the same way as the outer rear item and also includes the extra cropping operation in the 30-ton press.

Left-hand Inner Forward. Blanked, formed in the 800-ton press followed by a ganged operation of clip and pierce one hole, plunge one hole in a 750-ton press.

The remaining four items making up the complete star assembly, although not handled with the items already described, are produced in exactly the same way *i.e.* left-hand rear corresponds to the right-hand forward.

The crossbrace is then assembled in four sections. First the two halves of each section are carbon-arc welded which gives the four prongs of the star, left-hand front and rear and right-hand front and rear. These are then hand welded together at the centre intersection point. Several brackets are welded on and the lower part of the brace stiffened. Finally a gusset plate is welded onto the centre of the star.

Front Pan

The outer sections of the front pan assembly are designed so that they can be made in one piece and then split to form left and right hand items. The material used is 12-s.w.g. EN2A/1. The sheet is split then blanked and pierced in an 800-ton press. The next three operations are ganged in a 750-ton press and entails drawing and planishing and a clipping operation of the base. The side is then clipped and the flange clipped and the item parted across the centre to form the left-hand and the right-hand items.

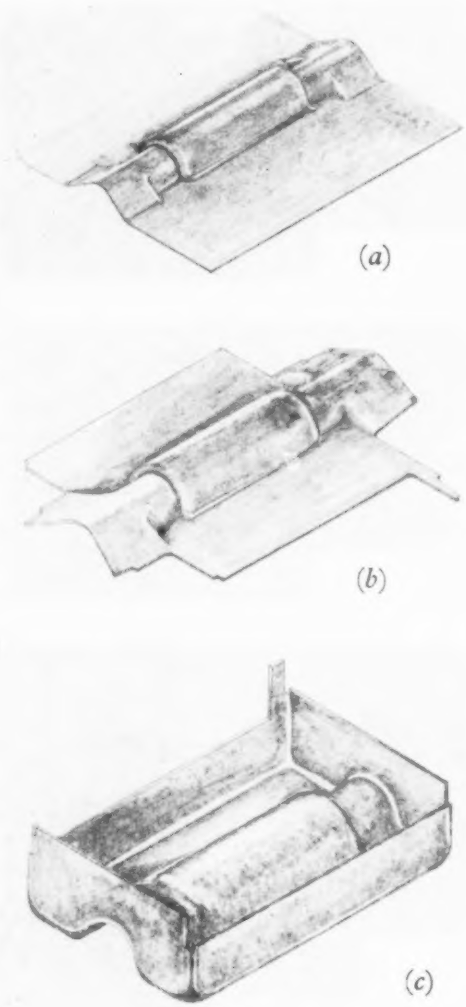
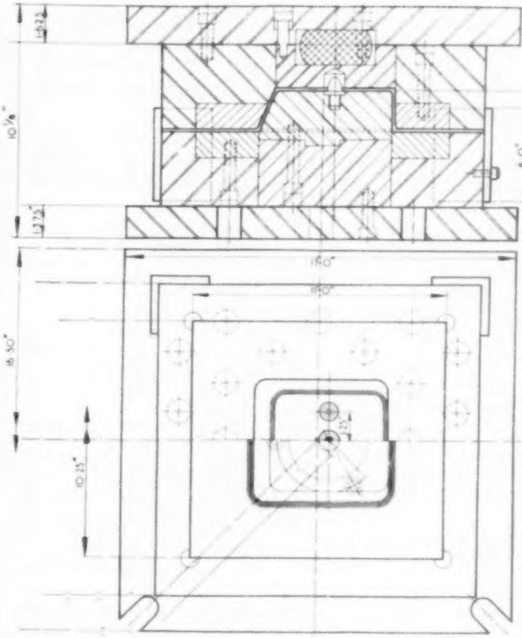
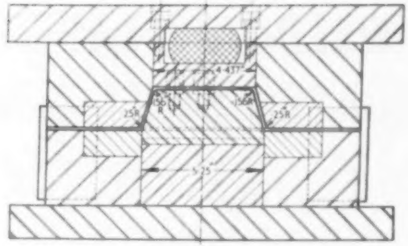


Fig. 109.—*Three operations in the manufacture of the steering box bracket : (a) form ; (b) clip ; (c) sides formed and welded*





effected in a 750-ton press. It is then planished in a 600-ton hydraulic press and the flange clipped in an 800-ton press. The flange is pierced and cropped and the base of the item cropped. A final pressing is effected in a 600-ton hydraulic press and holes plunged. A stiffening piece of 13-s.w.g. EN2B is added at a later stage.

Support Bracket for Steering Box

Manufactured from EN2B, 12-s.w.g., the sheet is sheared and drawn in a 180-ton press and then clipped and pierced in the same press. The sides are folded in a 75-ton press and the corners welded up.

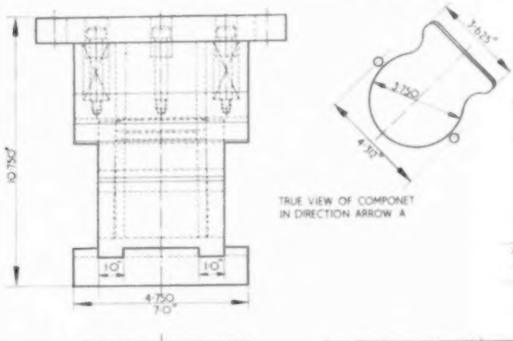
Rear Spring Front Anchor Bracket

Considering the size of this item the work required to produce it would appear somewhat out of proportion, but the accuracy required justifies the means. It is made from 12-s.w.g. EN2B sheet which is split and then blanked in the 200-ton press. At the same time two holes are pierced and serve as locating holes for further operations. The holes

(*Continued in page* 333)

Front Pan Centre Section

The centre section, as can be seen from Fig. 106, has a very intriguing shape and much thought was given to it before tooling. It is manufactured in one piece from 12-s.w.g. EN2A/1 sheet. The plate is sheared and the first drawing operation



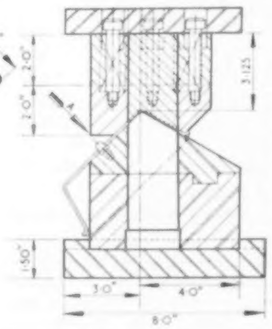


Fig. 110 *(above).—Drawing tool for rear spring front anchor bracket in which two holes of different diameters serve to make location possible one way only*

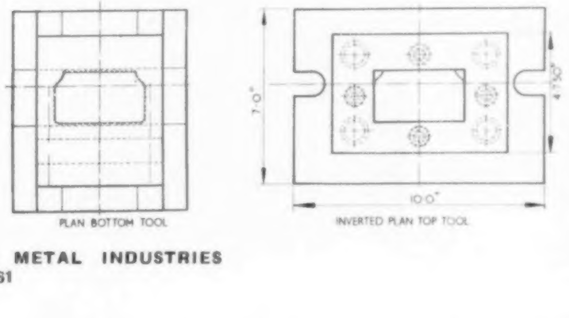
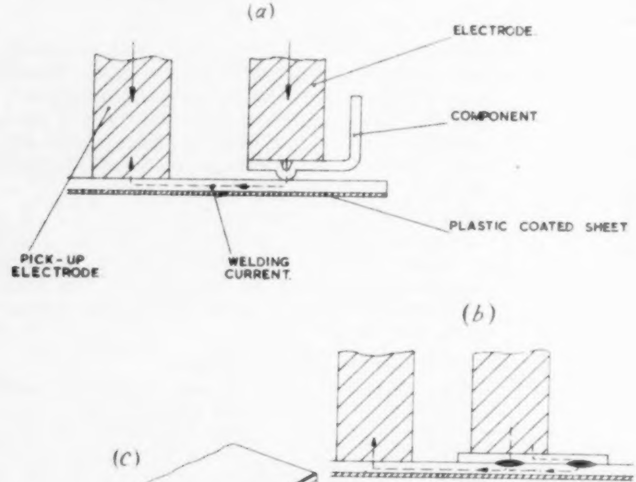


Fig. 111 *(left).—Piercing tool for flange of rear spring front anchor bracket.*

WELDING PLASTIC-COATED STEEL SHEET

New Resistance Welder for Attaching Stiffeners



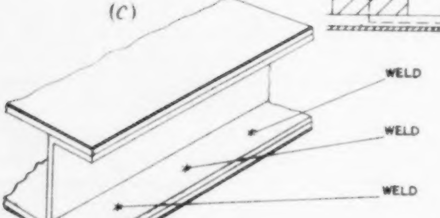


Fig. 1. (*left*)

(*a*) *Indirect series projection weld produced by a high-current short-duration pulse.*

(*b*) *Welding current shunted away by previous weld necessitating increased welding current.*

(*c*) *Series projection welding for use where there is no access to the metal face of the laminate*

THE availability of plastic-coated sheet in the past few years has drawn attention to the necessity for the development of welding methods suitable for this material.

One method has been to use a high-current short-duration pulse to make an indirect series projection weld as shown in Fig. 1 (*a*). With this method the welding time is of the order of 0.01 seconds to enable welding to be carried out on one side of the sheet without disturbing the plastic coating on the other. This method is quite satisfactory for welding on components such as nuts and studs where only single welding operations are required. The drawback is that when welding on long stiffeners, several successive welds have to be made, and previous welds " shunt " away some of the welding current (Fig. 1 (*b*)), thus the welding current has to be increased as welding progresses.

This disadvantage is now overcome by a new welder developed by Hirst Electronic Ltd., of Crawley, in co-operation with John Summers and Sons Ltd., manufacturers of " Stelvetite " plastic-coated sheet.

The new machine, known as the " Pulse-Tite " achieves this adjustment automatically. In principle, the problem is simple—how can the voltage across

(*Continued in page* 358)

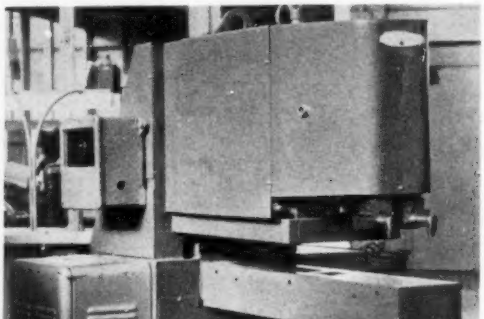


Fig. 2 (*below*).—*The new 'Pulse-Tite' machine developed by Hirst Electronic Ltd., in co-operation with John Summers & Sons Ltd.*

Allocations of Overheads in SHEET METAL WORKING

By J. W. LANGTON, M.B.E., B.Sc.(Lond.), M.I.Mech.E.*

ACCORDING to the text books, prime factory cost is made up of three elements, *viz.* direct labour, direct material and overheads. Overheads are defined as those costs which cannot be charged to the job direct, *i.e.*, are really all costs outside of direct labour plus direct material. These overheads may be sub-divided in various ways to suit the circumstances or the will of the factory accountant, such as grouping into production overheads, sales overheads, etc., but withal have to be allocated to the job costs in some manner.

There are various ways of doing this allocation, and perhaps the two most common in the sheet-metal-working industry are: (*a*) Percentage on Direct Labour; (*b*) Machine Hour Rate Plan. The first is the most commonly used, probably because it is the one very easy to use, the total overheads being expressed as a percentage of the total direct labour. Where there are in use a number of machines of greatly varying value with greatly varying ancillary running costs, this plan gives allocation very far from the truth. Any allocation of overhead can only be approximate, but the more accurate it is the more accurate the final cost.

The machine hour rate method is much more accurate in most circumstances. When first applied, it does call for a fair amount of work in a medium-sized business, but once this has been done, with coded expense recording, it can be checked, and brought up to date at the end of any cost period, in a short time.

The main object of this text is to discuss how the machine hour rate method can be developed and applied.

First Definitions

Before discussing the main object it is as well to establish clear definitions of the three main cost elements. By *direct labour* is meant those labour charges which can be made directly and exactly to the specific jobs, and those alone. Charges for labour, such as the cost of foremen or labourers, which cannot be accurately charged to a job or jobs, are not included, and are listed as part of indirect labour.

Similarly, direct material charges are those which can be charged to specific jobs. Where material is used for several jobs and the amount to any specific job cannot be measured, it is recorded as indirect material.

Both indirect materials and indirect labour form part of the total overhead to be allocated, along with dozens of other items.

First Steps and General Rate

The first step is to separate all these items of overhead into two main groups, one which may be termed the productive group or production overhead, and the other the general overhead. The term general gives a definite clue to the separation and the degree of separation depends on the relative size of the overhead item to the whole. Most items are easy to group and decision on border-line cases are not difficult.

Examples of items for the two groups are :—

Production Overhead	*General Overhead*
Plant depreciation,	Management salaries,
Heating and lighting,	Office expenses,
Power,	Selling expenses,
Rent,	Advertising,
Rates, etc.	Indirect material, etc.

The total of the general overhead figure is found, and if this is divided by the number of *productive* man hours for the cost period, an hourly general rate is determined.

For example, if the total general overheads per annum were, say, £16,994, the production labour force 105 people working, say, 45 hours per week, the total man hours would be 236,250 and the general hourly rate— $\frac{16,994}{236,250}$ or 1s. 5¼d. per hour.

Production Overhead

The first part of the allocation work of this group of overheads is to determine the total productive floor space, and then to allocate this over all the machines and operations.

For any particular machine, the area should be determined not only of the machine itself, but the area round it required for its operation. Where

* F. J. Edwards and Co. Ltd.

there are gangways, portions of these should be added to the machine floor spaces, so that the total production area is completely allocated.

A manual worker in this regard should be considered on exactly the same basis.

From the production overhead should now be listed all the items of expense concerned with the production buildings, such as heating, lighting, rent, rates, taxes, building repairs, building depreciation, building and lighting maintenance. Separation of the portions of these for the offices, etc., are usually not worth the effort, but these portions could be separated if desired, and the office portion added to the general overhead.

These particular charges should be added, and then divided by the total production area in square feet to give a floor space charge.

For example, if the total building charges per annum were £2,018, and the productive floor space 19,331 sq. ft., the machine floor space charge would be 2s. 1d. per sq. ft. The use of this figure will be shown when building up the machine hour rate.

Machine Hour Rate

There is still a portion of the production overhead to allocate, consisting mainly of depreciation, power, machine maintenance, etc.

So far as the power charge for the factory is concerned, the average cost per horse-power per annum should be determined, and, of course, the horse-power for each machine determined.

In allocating the maintenance charges, each machine (or group of exactly similar machines) has to be considered specifically and a maintenance charge determined for it, by the works management.

Also for each specific machine or group charges have to be made to cover for it or them what may be termed loose tools and fixtures, and also any other items specifically for that group. The reference to groups of similar machines means that it is advisable to consider together machines of the same size and capacity, irrespective of location unless there are very marked differences between them in the main items of overhead with regard to them. Thus, one machine hour rate is established say for the 6-ft. by $\frac{1}{8}$-in. guillotines, averaging in most cases their overhead expense items.

By way of illustration, a fictitious example can be made for, say, a guillotine which might work out somewhat as shown in next column.

Note the assumption of the working hours, *i.e.*, 50 weeks at 45 hours per week, which figure, of course, must be an approximation of the number of hours actually worked. If the machine only works half a week then the machine hour rate is doubled.

MACHINE HOUR RATE—6-ft. by $\frac{1}{8}$-in. guillotine

	£	s.	d.
Power, 5 h.p.	11	17	6
Depreciation in £683	45	10	8
General maintenance	5	0	0
Loose plant charges—			
Gauges and support tables	3	0	0
Blades	12	10	0
Floor-space charge—			
116.5 sq. ft. at 2s. 1d.	12	2	8
Total	£90	0	10

Estimated working hours per annum, 2,250.

Machine hour rate $= \frac{£90\ 0s.\ 10d.}{2,250} = 9\frac{1}{2}d.$ per hour.

Total overhead rate for machine =
(M.hr.) $9\frac{1}{2}$d. + general rate 1s. $5\frac{1}{4}$d. = 2s. $2\frac{3}{4}$d.

Manual Labour Rates

The same principles hold here, considering the man, his bench, and tools as a machine. An illustration devised to illustrate might be somewhat as follows, for a group of, say, 39 men :—

MANUAL HOUR RATE

	£	s.	d.
Depreciation on various machines used by them (small drills, grinders, lifting tackle etc.)	370	6	0
Loose tool charge	136	10	0
Indirect material	78	0	0
Total group	£584	16	0
Per man	£14	19	11
Floor-space charge 207 sq. ft. per ann. at 2s. 1d. per sq. ft.	£21	11	3
Total per man	£36	11	2

Taking annual working hours as 2,250.
Manual hour rate = 4d.
Total overhead rate = 4d. + 1s. $5\frac{1}{4}$d. general rate.
= 1s. $9\frac{1}{4}$d.

No detailed comparisons should be made between these two worked out cases of guillotine and manual hour rate—they are fictitious illustrations only. In practice, a wide variation in the values of the hourly rates might be found, really a justification of the use of this method.

Overhead Summary

When all the rates are worked out there should be a summary check to make sure that the total overhead will be fully recovered under the presented circumstances and working hours. If either of these change, then the rates must be adjusted accordingly. Periodic checks, at the end of each cost period, must in any event always be made, and with coded items of account this is not difficult.

It is also essential to record the actual number of hours each machine works. One method of doing this is to fix to each machine a machine operation card to be filled in each time the machine

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Production Procedures at the Beacon Works of John Thompson Motor Pressings Ltd.

(*Continued from page* 329)

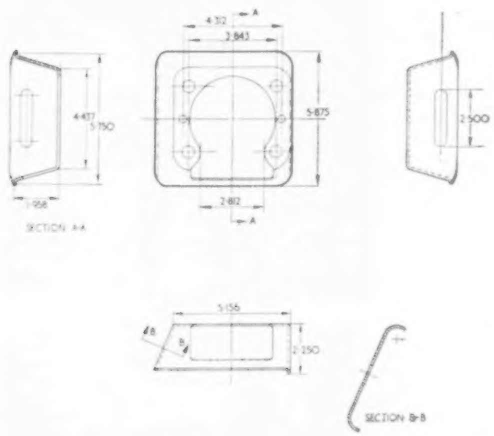

Fig. 112.—*General view of rear spring front anchor bracket showing key-hole opening in top face*

are of different diameter so that location can only take place one way. The first draw is effected in the 200-ton press. The flange is then clipped in the 75-ton press followed by a redraw, to deepen the first impression in the 200-ton press. The bottom of the item is pierced to give it a key-hole-shaped opening and six holes pierced in the 75-ton press. The next press operation pierces the side of the item followed by a final piercing operation which produces a slot in the opposite flange.

Body-mounting Brackets

Considerable effort has been made to ensure a firm fixture of the body when mounted on the chassis. The number one body-mounting bracket just forward of the rear engine mounting is the biggest and most interesting of them. It is fabricated from clad blanks of 12-s.w.g. EN2B for the front and rear pieces with suitably shaped pressed 13-s.w.g. soft-tempered items welded to the end pieces top and bottom. These are stiffened with 12-s.w.g. plate. A support tube in 16 s.w.g. EN2B is then welded across the chassis end of the bracket.

The number two body mounting bracket is made in one piece from 13-s.w.g. EN2B, blanked, pierced and formed in a 200-ton press. Its section is the more usual U-shaped, with side stiffeners.

(*Series to be continued*)

Allocation of Overheads in Sheet-metal Working

(*Continued from page* 332)

is used. Alternatively, it is possible to pick up the information from a correctly designed time sheet. There is some virtue in running both methods at the same time. A simple suggested time sheet is shown illustrated from which the overhead check figures might be obtained.

Estimating and Costing

The use of the machine hour rates in both estimating and costing is quite easy. It is usually advisable to keep the direct charges and the machine hour rates separate, and not for example, to add the operators wage rate to the machine hour rate and use them together.

Conclusion

As the machinery used in sheet-metal working becomes more and more costly, the use of a machine hour rate becomes more and more desirable.

One item not included in the machine hour rate case examples was that of capital return. Some accountants like to add in the compilation of the rate an amount for the use of the capital involved. There are various " pros and cons " for such a course but the author rather prefers the method of adding the profit finally to the total cost, which, of course, must provide for a proper return on the capital.

A.B. Co. Ltd. DAILY TIME SHEET

Name, Charles Smith Check No. 101 Date 29/Feb./60.

Job No.	Operation	Machine No.	Hours	M/C hr. rate	Overhead recovery	Labour rate	Labour cost
				s. d.	s. d.	s. d.	£ s. d.
864	Cutting	26	1¼	2 2¾	2 9¼	5 0	0 6 3
864	Folding	30	2½	2 0	5 0	5 0	0 12 6
864	Benchwork	133	6	1 9¼	10 7½	5 0	1 10 0

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By way of illustration, a fictitious example can be made for, say, a guillotine which might work out somewhat as shown in next column.

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Estimated working hours per annum, 2,250.

Machine hour rate $= \frac{£90\ 0s.\ 10d.}{2,250} = 9\frac{1}{2}d.$ per hour.

Total overhead rate for machine =
(M.hr.) 9½d. + general rate 1s. 5¼d. = 2s. 2¾d.

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Total per man	£36	11	2

Taking annual working hours as 2,250.
Manual hour rate = 4d.
Total overhead rate = 4d. + 1s. 5¼d. general rate.
= 1s. 9¼d.

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(*Continued from page* 329)

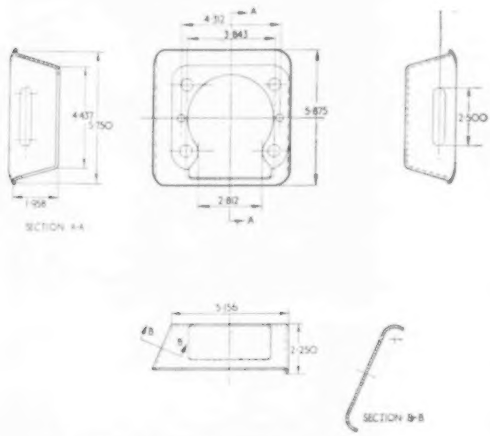

Fig. 112.—*General view of rear spring front anchor bracket showing key-hole opening in top face*

are of different diameter so that location can only take place one way. The first draw is effected in the 200-ton press. The flange is then clipped in the 75-ton press followed by a redraw, to deepen the first impression in the 200-ton press. The bottom of the item is pierced to give it a key-hole-shaped opening and six holes pierced in the 75-ton press. The next press operation pierces the side of the item followed by a final piercing operation which produces a slot in the opposite flange.

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(*Series to be continued*)

Allocation of Overheads in Sheet-metal Working

(*Continued from page* 332)

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864	Folding	30	2½	2 0	5 0	5 0	0 12 6
864	Benchwork	133	6	1 9¼	10 7½	5 0	1 10 0

CORRUGATING MACHINE FOR SUPER ALLOYS

High Accuracy for Aircraft Parts

SINCE conventional methods of forming corrugated sheet metal are unsuitable for the precise requirements of ultra-high-speed aircraft, manufacturing research engineers of the Aero-Space Division of the Boeing Airplane Company have developed a new machine that automatically forms corrugated sections from super-alloy sheets to very close tolerances.

The super-alloys employed, consist primarily of nickel-and cobalt-base metals which are capable of withstanding, relatively well, the high temperatures and thermal stresses of hypersonic flight. Such corrugated super-alloy sheets can be spot-welded between two smooth sheets of similar metal to form a sandwich panel for use in aircraft wings or fuselage skins.

Consisting of two tables with movable and hydraulic punch and pressure bar between them, the Boeing-developed machine was used for forming

(*Continued in page* 348)

Fig. 1 (*right*).—*Three views of the corrugating machine showing the varying positions of the two tables, the hydraulic punch and pressure bar*

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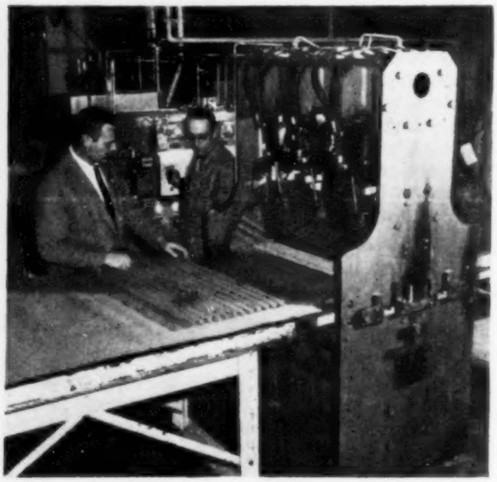
Fig. 2 (*below*).—*General view of the new machine in operation*



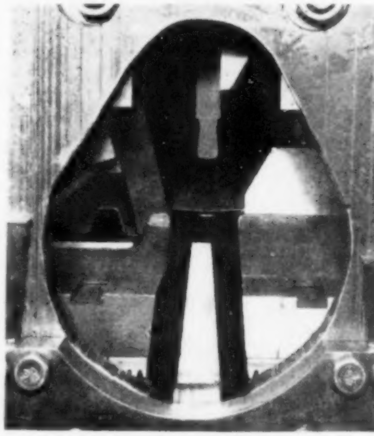


Fig. 1 (*a*)

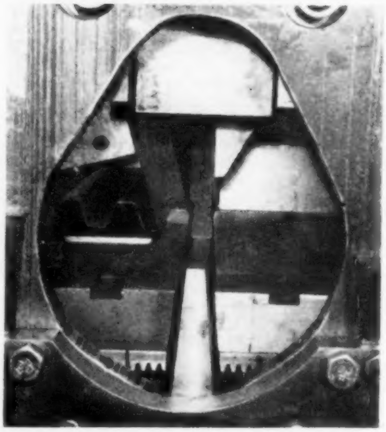


Fig. 1 (*b*)

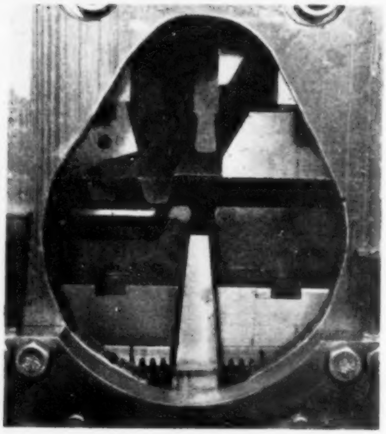


Fig. 1 (*c*)

COLD EXTRUSION OF SMALL SYMMETRICAL AND ASYMMETRICAL COMPONENTS

(A paper presented at the special Conference on Cold Extrusion of Steel, organized by the Institute of Sheet Metal Engineering, at the City Hall, Sheffield, November 21-23, 1960.)

By Prof. Dr. Ing. O. MAY*

UP to the present time, nearly all papers on this subject deal with backward or forward extrusion, or a combination of the two, of parts which are essentially circular and symmetrical in shape and largely with concentric bores and for this type of cold working mathematical relationships have been found.

Another type of extrusion, viewed superficially, has only so much in common with backward and forward extrusion in that the material is made to flow and thus with this process it is difficult to establish a limit.

It is necessary to consider, therefore, parts where, for example, the material flow is simultaneously vertical to the tool axis and also parallel or at an angle to it, which is very much more complex than the classic types of extrusion.

If simple forward extrusion as applied in the manufacture of, for example, bolts is carried to the extreme where the head has a very large diameter and is also many times thinner, and where the shank is many times smaller, the flow conditions are clearly quite different from those appertaining with a bolt. This type of extrusion is applied on forming of so-called tirets, parts which are essential in watches.

In this process the material, which for a bolt is a bar offcut with a diameter approximately the same as the head, has virtually become a thin strip of metal, out of which a pin or shank has to be pressed. While with the bolt there is simple flow of material through a hole in the die, here a large area of metal is under pressure and it is necessary to raise a portion of it into a very small opening against its natural resistance to flow.

In this extrusion operation (Fig. 1) the punch force in direction " A " squeezes the strip together over area " F ". The displaced volume of material tries to flow in a radial direction " B " and to rise upwards in the shank bore " S ". There is considerable resistance to flow in both directions but the greater resistance to the flow of metal is presented by the shank bore.

Considering this specifically, it will be found that the deformation consists of:

1. A pure upsetting procedure in which the thickness of the blank is reduced. The force required for this purpose amounts to

$$P_{S1} = F \cdot K_F$$

2. A cold-flow of the upset material in a radial direction. In this procedure, a strong friction, the so-called "flow resistance," occurs on the tool surfaces. The force required to overcome this flow resistance amounts to:

$$P_{Fl} = P_{S1} \cdot \frac{2}{3} \mu \cdot \frac{R}{h}$$

3. The actual flow of the material, the extrusion proper, into the bolt or pin hole when the material flows from the blank into the hole from a certain distance around it. This distance forms the "flow divide" or "no-slip" point between the material flowing into the pin hole and that flowing off in the outward direction. The formula for this relatively small force reads:

$$P_s = F_s \cdot K_F \cdot ln \frac{F_s}{f_s}$$

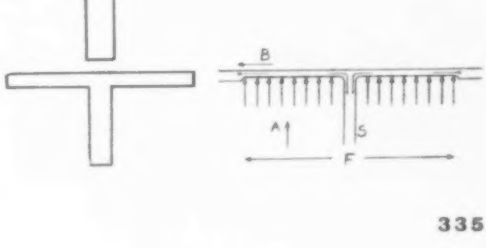


Fig. 1.

*Technische Hochschule, Stuttgart.

The total force then amounts to

$$P = P_{St} + P_{fl} + P_z = F \cdot K_F\left(1 + \frac{2}{3}\,\mu\,\frac{R}{h}\right) + F_S \cdot K_F \cdot ln\,\frac{F_S}{f_z}$$

The formula shows that the pressure stroke diagram of this process differs entirely from the diagram of a forward extrusion process. The diagram raises sharply to a highest force while with forward extrusion the force remains about the same during the whole process.

At this point, it may be desirable to mention the following extrusion phenomena :

It is a well-known fact that, when extruding a pin from an enclosed steel blank in a similar manner as when extruding a bolt, a maximum deformation of about 90 per cent may be attained. If an attempt is made to exceed this limit, the specific force per square inch would become too high.

On the other hand, it is possible when utilizing a non-enclosed blank, that is, a plate of any desired size, to extrude pins at a reduction ratio of over 99 per cent, that is, at a ratio which is practically unlimited.

This, however, still does not contradict our empirical value of a maximum deformation of 90 per cent relative to the diameter of a blank, since only a certain part of the volume of the blank will flow inwardly into the pin hole, whereas the other part will flow radially outwards in the opposite direction. The border between the two directions of movement forms the mentioned "flow divide" or "no-slip point" which is defined by a circle about the pin axis. This circular area is the determining factor for calculating the actual reduction.

If, for example, a pin of 1 mm. diameter is to be produced, the greatest possible diameter of the flow divide would—at a deformation of 80 per cent—amount to 2.2 mm. In reality, however, it amounts to less. The outer diameter of the total area which has been upset is calculated according to the equation :

$$\frac{4\,\mu}{h}\left[\int_{R_z}^{R}(x.R - x^2)\,dx - \int_{r}^{R_z}(x^2 - x.r)\,dx\right] = R_z^{\,2}.ln\frac{R_z^{\,2}}{r^2}$$

in which R = the radius of the blank,
R_z = the radius of the flow divide,
r = the radius of the pin,
h = the thickness of the blank, and
μ = the coefficient of friction.

This formula is an attempt to figure the outer diameter, but should be taken only as an indication. It gives for a friction coefficient of 0.15 at a blank thickness of 0.5 mm. the outer diameter of the total upset to be 5.1mm.

If the problem arises that the blank should be made smaller than 5.1 times the pin diameter, it would be necessary to increase the flow resistance of the material against its radially outward flow. This may be carried out by removing all greasy substances from the blank as well as from tool surfaces in order to increase the coefficient of friction. Thus, we are confronted by the peculiar fact that for a cold-extrusion process, the parts are not only *not* greased, but they must be *de*greased. This phenomenon was found and acted upon in practice by specialists in this particular field long before a reason for it could be ascertained.

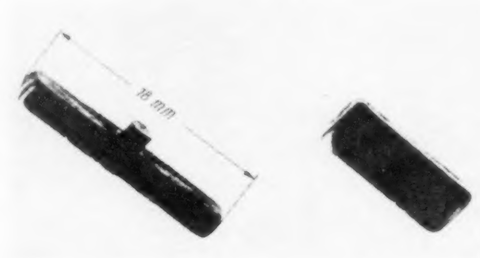
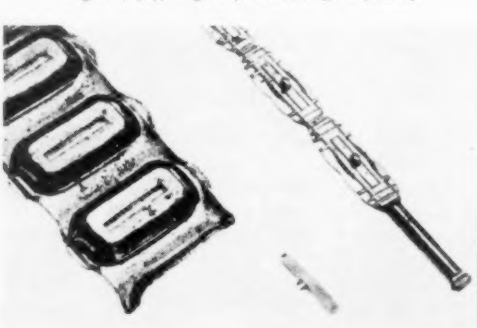


Fig. 2 (*left*); Fig. 3 (*above*); Fig. 4 (*below*).



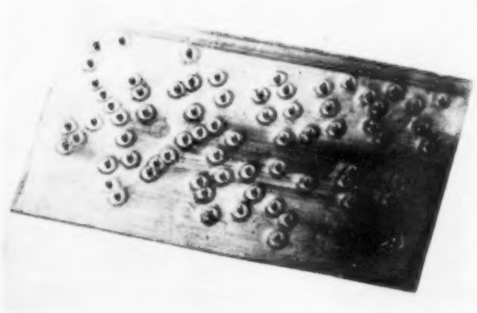
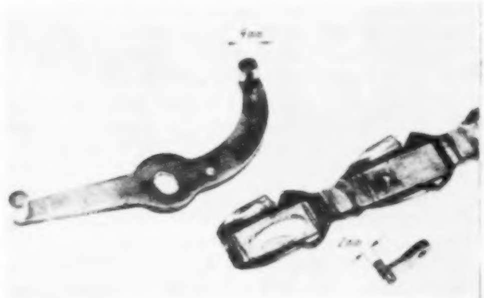


Fig. 5 (left); Fig. 6 (above); Fig. 7 (below).



If the braking action upon the flow due to the total removal of greasy substances from all parts is still not sufficient, a mechanical brake may be applied, for example, in the form of a tapered ring which is placed around the pin bore at a certain distance therefrom. This ring will dig into the material and thereby reduce not only the cross-sectional area of the outwardly flowing material, but it will also harden the flowing material considerably. This result of such a material brake is due to the fact that it diminishes the flow of the material in the radial direction toward the edge of the blank, and that therefore a greater volume of material is available for producing the pin.

In view of these observations it may well be concluded that, as the flow resistance increases and the cross-sectional area of flow diminishes, the flow speed, and thus the speed of deformation play an increasingly important part. Experience shows that such flow phenomena proceed much more satisfactorily at a slow flow speed.

These influences of the flow speed are the subject matter of investigations which are presently being carried out.

A part known to all watchmakers as a "tiret" will be considered. A tiret is usually a steel part which is produced from a small strip blank, or strip in coil form, from which one or more pins are extruded to serve as pivots for small gears or levers. With such parts the thickness of the basic plate portion, which is squeezed thinner during the operation, must be as accurate as possible ; the height of the pins must be as great as possible and held accurately to specified form.

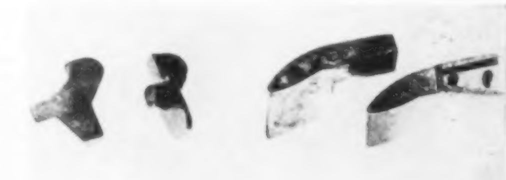
Up to recently these tirets have been pressed on eccentric presses, but always with great difficulty. The very high surface pressure ruined the expensive tools all too quickly, the thickness of the baseplate could only be maintained with great difficulty to the prescribed tolerances, and finally owing to special base forms it was extremely difficult to produce the complex pivots.

The watchmaker was probably the first to find from experience with tiret work that it was necessary to give the material more time to flow than was, for example, hitherto possible with the eccentric press.

On the basis of these experiences, a "slow flow press," has been built which, with the same operating speed and same stroke as an eccentric press, has a ram speed in the actual work zone much slower than that of the equivalent eccentric press.

The influence of speed alone explains why the required pressure was quite considerably reduced, why tool life was considerably extended and why the extruded pins or pivots were so high as to be actually too high. Thus, there was no need to thin the sheet-metal plate down as far as it used to be in

Fig. 8 (below); Fig. 9 (right).



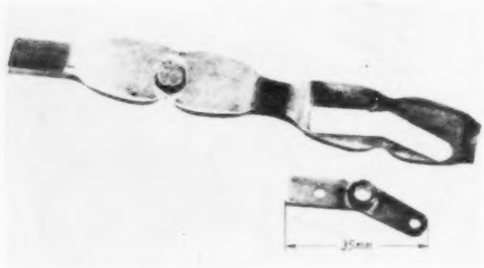
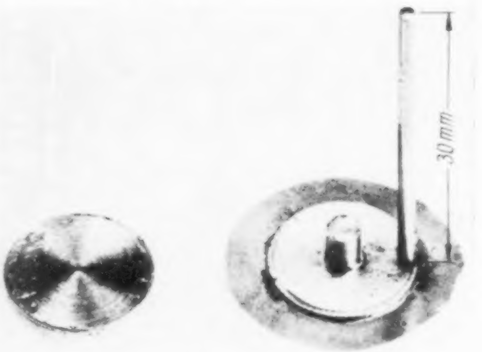


Fig. 10 (*left*); *Fig.* 11 (*above*); *Fig.* 12 (*below*).



order to obtain the required pin height, *i.e.*, it was possible to start with a blank about 20 per cent thinner to obtain the desired end form. A material saving of 20 per cent is in itself noteworthy.

A tiret plate with five pivots from the world-famous International Watch Corporation, Schaffhausen, is shown in Fig. 2. The tiret proper is stamped out of the pressed strip.

Fig. 3 is a component from a calculating machine. A cylindrical pin projects from a rectangular beam. Parts such as this were previously machined from the solid. Fig. 4 shows the new type of manufacture where, from coiled stock, pins are raised or extruded from the strip due to the " braking " effect of box-shaped recesses and are subsequently stamped out from the strip with the rectangular base. Ample material is required to do this.

A much better solution is to use circular-cross-section wire and by using methods to restrict material flow, force up pins in the top die, afterwards stamping out the part with its plate. Both methods of manufacture are carried out with automatic feed of material.

Extruded pins are also shown in Fig. 5 which is a plate for a musical box, and Fig. 6 a lock component which was previously hot stamped in brass on a friction screw press without achieving the desired accuracy and finish. It is now produced from steel blanks 2 mm. thick, which are upset to 1.77 mm. thick, whereby pins of 2 mm. diameter and 2.5 mm. high are raised. The material overflow is restricted by a step in the tool.

Fig. 7 (*left*) shows a lever with a pin, the raw material being 3-mm. thick steel strip. The pin is 4 mm. in diameter, and 5 mm. high. A similar product is shown on the right.

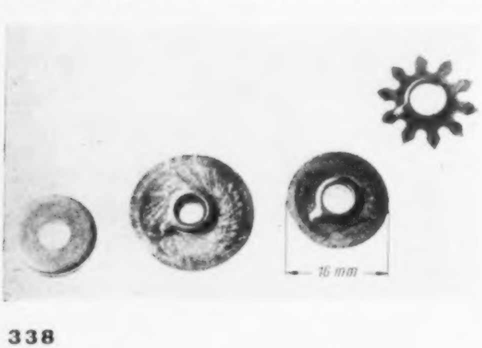
Fig. 8 is a camera lever, which is produced from rectangular wire ; this is a specially fine example of simplification by cold working. Previously the lever was machined from the solid.

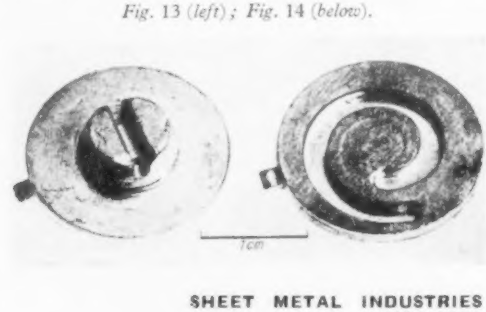
Figs. 9 and 10 show further interesting camera components.

Fig. 11 shows another method of restricting flow. A unique example of flow restriction on aluminium is shown by Fig. 12. The central shank is kept short by ejector limitation.

On another sample part the material is allowed to flow downwards from the thickness, for example with the small gear (Fig. 13) from a calculating machine, the blank of which is 2.5 mm. thick. The

Fig. 13 (*left*) ; *Fig.* 14 (*below*).





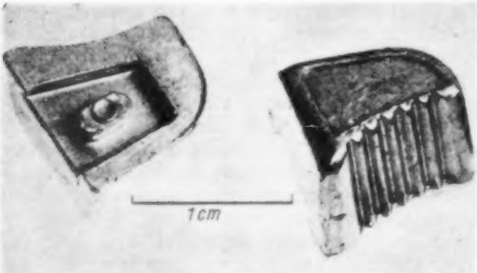


Fig. 15 (top); Fig. 16 (above); Fig. 17 (right)

projection is face turned and is 2.25 mm. high. This part was once machined at great cost.

Two parts which are completely asymmetrical are shown in Figs. 14 and 15.

One last interesting sample from this asymmetrical series, Fig. 16, is a cover for the head of an electric shaver, flow pressed from 3-mm. thick aluminium sheet. The finish form is almost produced in the first cold-forming operation, which is carried out automatically from coil stock at 60 per minute.

Fig. 18 (above); Fig. 19 (right)

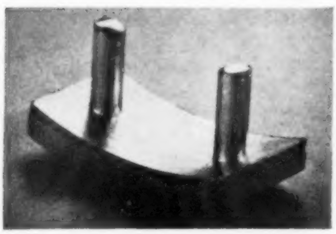
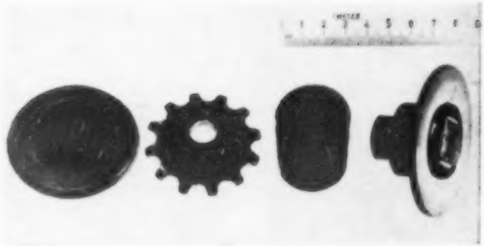


Fig. 20.—(left)



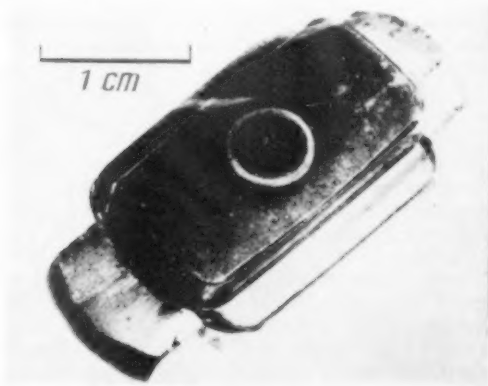
Symmetrical parts, where resistance to flow continuously increases towards the end of the operation, are chain wheels (Fig. 17), hubs (Fig. 18), as well as valve spring plates for a motor-car engine and a magnet core, (Fig. 19). The aluminium parts in Figs. 20 and 21 are difficult to classify; both parts, however, were previously machined from the solid. The most typical part is an aluminium component with two high pins (Fig. 20).

It might be asked, when does extrusion become coining?

The theoretical question, extrusion or coining, appears in the face of such examples to be unimportant.

However, the impression is given that a part must be carefully and slowly formed if it is typified by a lessening flow gap during the forming operation, an increase in material hardness, and increasing pressure. Perhaps one could introduce a term for this type of extrusion—slow-flow pressing. This method is not an extrusion process, but rather a kind of bastard process which has existed for a long time but which no one has bothered about very much. However, it has a much broader basis than the classic type and requires more imagination. Its laws have yet been insufficiently studied.

Here is an attempt to stimulate research. The transition from extruding conditions of the classical type to an extreme distortion of the new type involve phases which have become known from



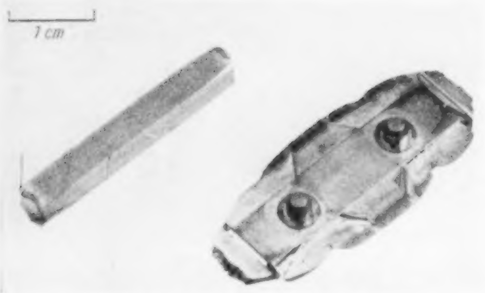


Fig. 21 (*above*); *Fig.* 22 (*right*).

previous investigations. It is known, for example, that it is possible to obtain a deformation or reduction of 75 per cent maximum with a cup that is not too high. However, at this rate the specific forming pressures rise to limit values. How these are composed is not known.

How much can be accounted for in internal friction and hardening, the surface friction, the heating, the influence of forming speed.

Taking as a border line case the paper-thin steel flash with which we are all familiar, when the material is forced into tool scratches produced by points of fracture or joints, is it possible to go deliberately towards this limit, at least on a small scale. This can only be done by specially designed tooling and special blank forms, to obtain local build-up of material and local overloading in order to obtain a degree of reduction hitherto not achieved.

In the opposite case the material, in comparison with the classic process, in most cases does not flow from the die under accurate control. On the contrary, it will take the path of least resistance away from the closing tools, which often means right out clear of the tools in the form of flash. With thinning and spreading flash there is sometimes a tremendous pressure build-up. This can be prevented, or at least stemmed, by the provision of material restrictors of various designs and the positioning and shaping of these is a province of its own.

DISCUSSION

Mr. MORGAN (R.O.F., Birtley) said that Dr. May had referred to the fact that a knuckle press had not been successful. He had added that they had reduced the speed of the coining material and achieved success, with better tool life. He had then said that 60 components a minute were produced, which was one per second. Could he explain this a little further, and give some idea of the principles used, and the speed of coining?

Prof. MAY replied that in this type of extrusion, speed did not seem to play an important role: it was possible to produce bolt, can or whatever it might be at any speed. In a process such as that for tirettes the pressure rose steeply upwards to the highest point then suddenly dropped. With the ordinary type of extrusion the flow was continuous and there was always the same "opening". With the former process the opening closed. There was no proof yet, but there was proof that one could take one of these presses—they were bought in very large quantities—and work it out. It seemed to depend on these steeply rising pressures.

Mr. MORGAN said that this parallelled to some extent work that he had done in connexion with the extrusion of top flanges on a bolt end. He had deliberately put a concavity on both tools so that, in point of fact, the orifice was always closing and the material being squeezed through. He had taken the raw material without any special preparation and had yet to experience a split on the outside diameter.

Mr. DREWERY (English Steel Corporation) referred an asymmetrical part shown in the paper with a short stub and a long 30-mm. extrusion. Could the author say whether the extrusion went through a die into free air, or was guided throughout its range? Why, since the paths to the extrusion orifice were completely unbalanced, did not the extrusion bend?

Prof. MAY replied that a good deal of experience was behind this work. Most of it was known to Swiss special tool makers who were handling this type of material every day. It was interesting in that the bore through which the pin had to pass must have absolutely sharp edges. This was contrary to what was ordinarily believed. The tool makers were the best men to ask. They knew more than anyone else about it. It was almost unbelievable that the pattern in question had been in only about 2 mm. thick aluminium and had come out at the height shown.

Mr. HARRIMAN (Raleigh Industries) asked whether important scale effects would be noted in going from a very small component, in steel, to a much bigger one. Did some things in the equation go up as the square of the dimension and some as the cube?

Prof. MAY said that it would probably be the same equation. The formula must come out in that way. It would be interesting to use these processes for larger components, in which case the pressure would rise enormously. Braking action was very important and it was necessary to have experience sufficient to indicate the degree of braking necessary to prevent the material from spreading out and taking up a tremendous surface.

Mr. WATKINS (NEL) asked Prof. May whether it was usual to experience the usual type of defect associated with extrusion, in that the amount of discard became very small and piping was produced?

(*Continued in page* 348)

OPEN-COIL • • ANNEALING*

By V. J. GIBBONS†

Introduction

IT is common practice in the steel industry to anneal sheet and tin-plate products by box annealing, by continuous annealing, and by continuous or cut-length sheet normalizing.

Box annealing is still the most widely used method for annealing flat-rolled steel products. Practices and equipment are well developed, and annealing costs are low in comparison with those of the other methods. However, box annealing has some serious disadvantages well known to most people.

The use of continuous annealing has grown tremendously in the past fifteen years, particularly for the production of tin-plate, electrical sheets, and galvanized sheets. In continuous annealing, the heating and cooling rates are very rapid and the entire surface of the steel is exposed to the controlled annealing atmosphere. Because the time at temperature during continuous annealing is very short, however, it is not possible to produce steel as soft as can be produced by box annealing. Furthermore, even though all the steel surface is exposed to the annealing atmosphere so that gas-metal reactions such as decarburization can occur, they can proceed only to the extent that the very short continuous-annealing times will permit.

At the AISE meeting two years ago, Mr. Lee Wilson described a newly developed annealing method for sheet and tin-plate called "open-coil annealing" that seemed to combine the best features of conventional box and continuous annealing without their inherent disadvantages.

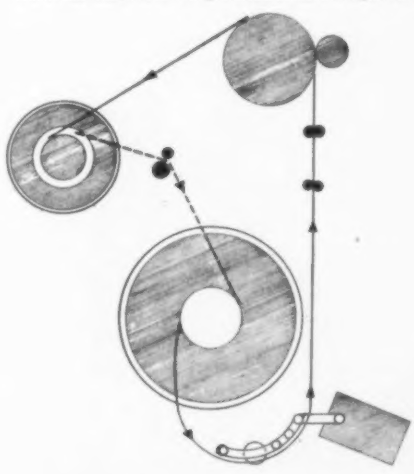
Equipment

The novel feature of open-coil annealing is the provision of "air space" or "separations" between the individual wraps of a coil so that hot annealing atmosphere gas can be circulated through the separations. This means that the entire coil can be heated and cooled much more rapidly and more uniformly than in conventional box annealing. Also, it has now been found that desirable gas-metal reactions can be carried to completion when the coil is "open" during annealing.

In the process as originally developed, the separations between wraps were obtained by means of a nylon string that was withdrawn from between the wraps before annealing. However, when the annealing is done to change the composition of the steel by what has been referred to as "gas alloying", it is often advantageous to use a more positive method for maintaining uniform spacings between wraps. In these instances, the nylon string can be replaced, for example, by ¼-inch wide corrugated strip, or by formed wire that remains in the "open" coil during annealing and that ensures positive wrap separation without restricting flow of the hot gas through the coil.

A commercial sheet-coiling unit is different from a commercial tin-plate unit only in that speeds and

Fig. 1.—Diagram showing method of obtaining "open coil". Dotted line shows path of steel when coil is being opened and solid line when it is being rewound into a tight coil



* Based on a paper presented to the Newport and District Metallurgical Society.

† General Manager, Lee Wilson Engineering S.A., Fribourg, Switzerland.

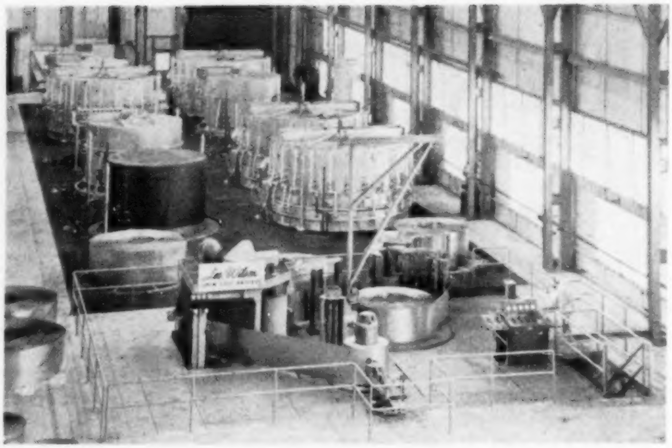


Fig. 2.—General view of complete "open-coil" annealing installation. In the foreground is the equipment for producing the "open-coil." This installation is at Empire Steel, Mansfield, Ohio, U.S.A.

tension devices differ. The tensioning units are normally only used during winding from an "open" to a "tight" coil after annealing. Commercial sheet units are designed to operate at speeds up to 1,200 ft. per min. during winding of an "open" coil before annealing and at speeds up to 800 ft. per min. during winding of a "tight" coil after annealing. Commercial tin-plate units are designed to operate at 1,500 ft. per min. during winding of both "open" and "tight" coils.

In the open-coil installations operating to date, annealing of the "opened" coils has been done in specially designed single-stack furnaces with bases, inner covers, and furnaces capable of annealing "opened" coils with outside diameters of 108 and 114 inches, large base fans that circulate the hot annealing gas at 30,000 cu. ft. per min. and specially designed plenums and diffusers for circulating the gas up past the inner cover and down through the opened coil.

Design and engineering work is virtually completed on a rotary-hearth continuous furnace that will permit conventional annealing at much lower cost than in the special single-stack equipment mentioned previously. A complete installation of this type with a capacity of 20 tons per hour of sheet products can probably be operated by two men. Coils will move to and from the installation on conveyors, and manipulators are provided to eliminate the need for an overhead crane to deliver and position the coils, for faster handling than a suspended crane hook permits. Such a unit has not yet been built although many open-coil units are operating with lift-off furnaces already.

Results of Experimental Annealing Studies

During the past four years, about 800 coils of steel have been annealed on the pilot open-coil annealing installation operated by the Research and Development Department of Lee Wilson Engineering Company at Elyria, Ohio. These test annealings were on production coils from U.S. and foreign steel plants. Facilities are also available for mixing many types of atmosphere gases, and for adding controlled quantities of water vapour to the annealing-atmosphere gas. A gas chromatograph and infra-red gas analyzer and a variety of dew-point measuring devices are now available for determining the composition of the entry and exit atmosphere gas throughout the annealing cycle.

Temperature Distribution

To measure temperature distribution during the entire annealing cycle, thermocouples were located at six locations in a number of open coils. By the end of the heating period (3½-hours elapsed time on 6½ N.T. coil), the temperature at the middle inside location of the coils was essentially the same as elsewhere in the coil; and shortly after the start of soaking (4½-hours elapsed time), the temperature at the bottom inside location was only about 25° F. lower than the temperature elsewhere in the coil.

A rapid rate of cooling is obtained by the use of a forced cooler that blows air over the inner cover in much the same fashion as with conventional single-stack annealing equipment. When the steel temperature reaches about 550° F., water is sprayed over the inner cover to increase the cooling rate down to uncovering temperature. Many coils used to obtain data are uncovered after about 12-hours total elapsed time (heating, soaking and cooling).

Conventional Annealing of Sheets

Samples from six 20-gauge cold-reduced rimmed-steel coils and from five 20-gauge cold-reduced

TABLE I—*Ranges of composition of the samples used in study of open-coil annealing temperatures and times—per cent*

Steel	C	Mn	P	S	Si	Cu	Al
Rimmed	0.04 to 0.10	0.31 to 0.45	0.004 to 0.017	0.024 to 0.028	0.01 to 0.02	0.04 to 0.24	—
Aluminium-killed	0.04 to 0.06	0.15 to 0.38	0.007 to 0.018	0.024 to 0.028	0.01 to 0.02	0.04 to 0.12	0.05 to 0.06

aluminium-killed steel coils were obtained from six steel companies. The coils were randomly selected and exhibited the ranges of composition shown in Table I. A 9-ton coil was "opened" with the nylon string and samples, 12 inches long by coil width (about 36 in.), from each of the six rimmed-steel coils and from each of the five aluminium-killed steel coils were inserted between the wraps of the 9-ton "dummy" coil. The same dummy coil was used with different samples to conduct anneals for times in the range from ½ to 4 hours at temperatures in the range from 1,260 to 1,340° F. (680 to 730° C.). DEOX annealing gas produced with an air-to-gas ratio of 6 to 1 was used for all the anneals.

The average hardnesses of the annealed rimmed-steel samples are presented in Fig. 4. The softest product was obtained by annealing at 1,320° F. (710° C.), and annealing for four hours at this temperature gave very little advantage over annealing for one and for two hours. It appears that rimmed steel open-coil annealed for one to two hours in the range 1,300 to 1,340° F. (700 to 730° C.), will develop about the same hardness as rimmed steel that has been annealed for much longer times by conventional box-annealing methods.

The average hardness results obtained on the aluminium-killed steel samples, which are presented in Fig. 5, also indicate that little or no decrease in hardness is obtained by extending the time at temperature from two to four hours.

It should be pointed out that several additional trials were made on both the rimmed and the aluminium-killed steels with time at temperature extended to eight hours. This long annealing time did not result in a significant hardness decrease.

Subsequent to completion of the work on these samples, annealing studies were conducted on full coils of both rimmed and aluminium-killed steel. The results presented in Table II were obtained on 13-ton coils of 20-gauge steel that were annealed for two hours at 1,340° F. (730° C.) in DEOX gas supplied to the charge at about 500 cu. ft. per hr. The annealed coils were temper-rolled in the normal fashion for drawing-quality sheets (about ½ per cent extension), and the mechanical properties and microstructure were determined at the edges and centre of sheets obtained from the coils at locations corresponding to the outside, centre, and inside of the coil during annealing. The average mechanical properties and grain-size were within the ranges normally observed for these steels after conventional box annealing. The total furnace time for these two coils was six hours, and the total base time was 14 hours. These times are much shorter than those required for conventional box annealing of drawing-quality sheets. Nevertheless, the uniformity of mechanical properties exhibited by these open-coil annealed coils was superior to that generally exhibited by conventionally box-annealed coils. It is of particular importance that the elongated grain structure, which is associated with the outstanding

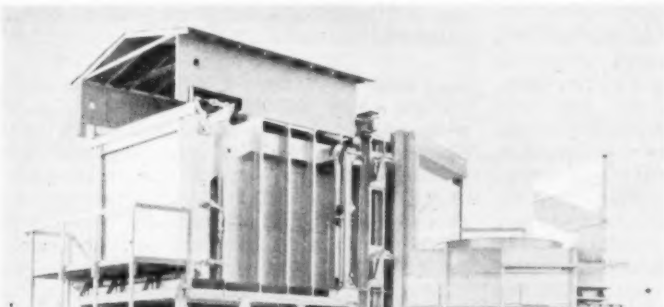
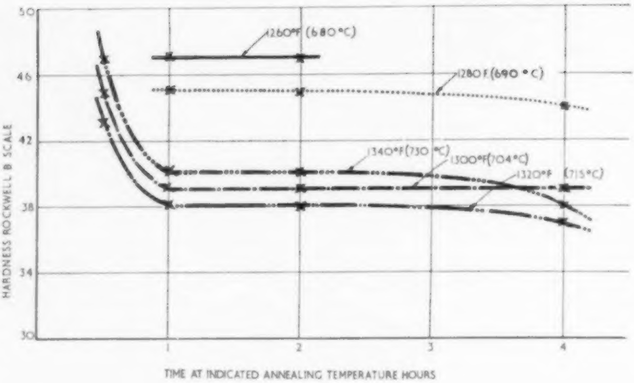
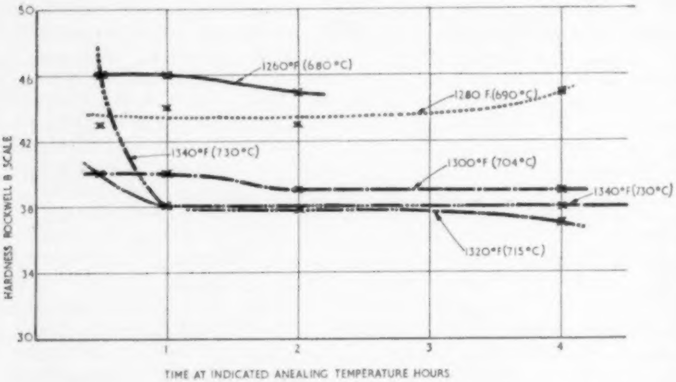


Fig. 3.—Full-scale rotary furnace mock-up for "open-coil" process. This illustration shows the entrance to the purging vestibule with door-operating mechanisms and section of rotating hearth
(Courtesy of Lee Wilson Engineering Co. Inc., Cleveland, Ohio, U.S.A.)

Fig. 4 (right).—Effect of open-coil annealing time and temperature on the hardness of 20-gauge rimmed steel

Fig. 5 (below).—Effect of open-coil annealing time and temperature on the hardness of 20-gauge aluminium-killed steel





formability of box-annealed aluminium-killed steel in many difficult drawing applications, was developed by the short-time open-coil annealing cycle used.

Gas Alloying

The fact that certain gases will react at elevated temperature with some of the elements in steel has long been known in the steel-producing and steel-consuming industries.

Except for the silicon-steel sheets used in electrical equipment, which represent a very special case from the metallurgical point of view, the known principles of gas-metal reactions during annealing have not been generally applied to the manufacture of flat-rolled products in the steel industry. The reason is quite simple and valid—suitable equipment in which the reactions could be economically and consistently accomplished was not available. Although the times involved in conventional box annealing are long, the active annealing gas does not have easy access to the surfaces of the steel in the tightly wound coil. As a consequence, the reactions proceed very slowly and non-uniformly, if at all, and they are virtually impossible to control.

Although all the surface of the steel is exposed to the active annealing gas in continuous annealing, the steel is at the reaction temperature for too short a time to permit the reactions to proceed beyond the very preliminary stages.

In open-coil annealing, the entire surface of the steel coil can be exposed to the active annealing gas for as long as may be necessary for the steel-gas reactions to proceed to completion and the gas atmosphere and humidity can be changed readily. As a consequence of these four features, it has been found practical to change the composition of commercial-size coils of flat-rolled steel during open-coil annealing and, thereby, to produce new, improved, and lower-cost steels. The following discussions are intended to summarize the results of some of the studies that have progressed furthest along this line.

Enamelling Steel

High-quality enamelling sheets have long been made from low-carbon, low-manganese steel (0.03 per cent carbon, 0.08 per cent manganese) which grade is difficult to hot roll and to recrystallize during annealing. Furthermore, two separately applied enamel coats are necessary to insure that parts made from this steel are free of objectionable enamel defects. It has now been found that ordinary rimmed steel, which contains about 0.06 per cent carbon and 0.40 per cent manganese and which is easy to hot roll and recrystallize, can be made into a very satisfactory enamelling steel by open-coil annealing to remove almost all the carbon from the steel. The decarburization can be successfully accomplished by annealing in either hydrogen-nitrogen gas or DEOX gas provided that controlled

TABLE II

Mechanical Properties and Grain-size of regular Open-coil Annealed 20-Gauge Sheet Steel Coils (not gas alloyed)

Property		Rimmed	Aluminium-killed
Hardness, Rockwell B..	Average Range	40 37 to 44	43 42 to 45
Olsen cup depth, in. ..	Average Range	0.41 0.40 to 0.42	0.42 0.41 to 0.43
Yield strength, lb. per sq. in.	Average Range	29,200 29,150 to 29,250	26,900 26,500 to 27,550
Tensile strength, lb. per sq. in.	Average	44,700 44,400 to 45,100	45,900 45,900 to 46,700
Elongation, * per cent in 2 in.	Average Range	39 38 to 40	39 39 to 40
Grain-size, ASTM No.	Range Shape	7 to 9 Equiaxed	6 to 8 Elongated

* Converted from Rockwell 30–T.

Typical physical properties of rimming steel converted to non-ageing by open-coil annealing at 1300° F in wet hydrogen

Charge No.	Location	Yield strength (lb. per sq. in.)	Tensile strength (lb. per sq. in.)	Elongation in 2 in. (per cent)	Hardness Rockwell B*	Ageing index at 212° F., 4 hours
A	IOC (inside open coil) ..	25,600	40,900	46	22	2
	OOC (outside open coil) ..	23,300	39,200	47	20	5
B	IOC	27,500	39,800	48	30	0
	OOC	23,900	39,000	49	29	1

Note.—All values are averages of duplicate tests except hardness which is average of 15 tests.

Ladle Analysis of Steel—per cent

Charge No.	C	Mn	P	S	Si	Cu	Ni	Cr	Sn	Mo
A	0.07	0.37	0.007	0.021	0.008	0.04	0.03	0.01	0.006	0.01
B	0.07	0.39	0.008	0.020	0.006	0.02	0.01	0.02	0.005	0.003

quantities of water vapour are added to the gas during the soak period of the anneal.

Gas analyses revealed that significant quantities of carbon monoxide (up to 2 per cent) were present in the outlet gases during about the first four hours of soak in moist 8 per cent hydrogen gas. Also, with coils annealed in 8 per cent hydrogen gas, the dew-point of the outlet gas does not increase to the same level as that of the inlet gas until after no evidence of carbon monoxide is observed in the exit gas. This would indicate that the carbon at the steel surface reacts with the oxygen in the gas, which is present as water or as water and carbon dioxide, to form carbon monoxide. More important, however, accurate measurements of carbon monoxide in the outlet gas, supplemented by measurements of the dew-point of the outlet gas, will provide a positive means for deciding when the soak period for a particular enamelling-steel charge should be ended.

Since the two-coat enamelling characteristics of ordinary rimmed steel decarburized during open-coil annealing are excellent, it can be substituted for the difficult-to-roll low-metalloid steel that has heretofore been the standard enamelling-grade steel. Of even greater importance, however, is the fact that this open-coil-annealed steel can be enamelled satisfactorily with one white or light-coloured coat. That is, it is not necessary to apply the dark-blue ground coat of enamel that has been used on low-metalloid steel as the base, in customary enamelling practices.

The excellent "direct-on" enamelability of the open-coil annealed steel has been well established by many tests made to date in the enamelling industry, and several U.S. companies are offering the product for commercial delivery. As more of the open-coil annealing installations are placed in operation and the availability of the product increases, it will probably replace most of the low-metalloid steel now used in the enamelling industry. Depending upon economics, the open-coil annealed

steel may also replace the box-annealed rimmed steel that is presently being used for non-critical enamelling applications.

Single-coat enamelling sheets permit a substantial reduction in costs at enamelling plants.

Non-ageing Steel

It is characteristic of rimmed steel to age during storage after complete processing in the steel mill. The ageing is manifested by an increase in hardness, a decrease in ductility and formability, and a return of the yield point. When the utmost in formability and stability of properties is required in a particular application, therefore, it is generally the practice to use a non-ageing aluminium-killed steel. Aluminium-killed sheet steel is more expensive than rimmed steel and it has a poorer surface. Therefore, the steel industry has long been searching for a product that will combine the excellent surface quality of rimmed steel with the non-ageing and excellent forming quality of aluminium-killed steel. Vanadium-treated steel and boron-treated steel, for example, were developed mainly to meet this objective, but neither has been generally accepted as the product combining the desirable properties of present rimmed and aluminium-killed steel. Open-coil annealing offers another way in which the desired new product may be produced.

About twenty years ago, *Low* and *Gensamer* found that samples of rimmed-steel sheet could be made non-ageing by laboratory-scale annealing in moist hydrogen gas. Until the advent of open-coil annealing, however, commercial equipment was not available for the application of *Low* and *Gensamer's* findings to the processing of commercial-size coils of sheet steel.

The accelerated ageing indices of many non-ageing rimming-steel coils produced during open-coil annealing have been compared to similar results obtained on "control" samples of box-annealed rimmed and aluminium-killed 20-gauge sheet steel. As might be expected, the ageing index of the rimmed-steel "control" was high, in the order of 25 per cent. Although aluminium-killed steel is commonly referred to as a non-ageing steel, the ageing treatment used in these tests, four hours at 212° F. (100° C.) after straining, was sufficiently severe to cause a small but significant amount of ageing in the aluminium-killed "control" steel (6 to 8 per cent), whereas standard rimming steel rendered non-ageing during open-coil annealing will normally age only 0 to 5 per cent.

Humidity control and atmosphere are, of course, important factors in rendering rimming steel non-ageing. 100 per cent H_2 is the most effective atmosphere but much test data indicates that up to 30 per cent nitrogen can be tolerated as an impurity in the annealing gas without seriously impeding removal of nitrogen from the steel. The 70 per cent hydrogen gas used in the annealing of some coils was made by mixing high-purity bottled hydrogen and nitrogen. Nevertheless, it appears that the non-ageing steel could be produced by annealing in cracked ammonia or in hydrogen gas generated from natural gas provided that they do not contain significant quantities of undesirable contaminants such as ammonia, methane, and carbon monoxide. Obviously, the economics of this annealing treatment are much more favourable if cracked ammonia or generator hydrogen can be used rather than high-purity bottled hydrogen.

In summary, sufficient work has been done to establish that open-coil annealing can be used to produce commercial quantities of non-ageing rimmed steel by removing carbon and nitrogen from the steel as first accomplished by *Low* and *Gensamer*. The most economic annealing conditions to achieve this end are now being established and of equal importance, the formability of the product is being evaluated in actual deep-drawing applications. It is noteworthy that rimming steel can be made non-ageing only ; or, by extending the cycle, it also permits the entire elimination of the yield point, and coil breaks. This would, of course, deliver an extremely soft material.

The concensus of opinion and intent among the American steel companies seems to be a desire to only treat rimming steel in a manner which will make it non-ageing after temper rolling. Rimming steels of many types have been rendered non-ageing ; including open hearth, electric furnace, Thomas, LD, air-blown Bessemer, etc.

The physical properties of many such coils have been outstanding. On 20-gauge sheets, it has not been uncommon to achieve Rockwell B under 30, elongation in 2 in. of higher than 50 per cent, and Olsens above 420, all with ideal yield and tensile properties.

Table II gives the actual analyses of such steels, along with the physical properties developed by the non-ageing anneal, plus the percentage of ageing which occurred after four hours at 212° F. (100° C.).

Tin-plate

Box annealing is well suited for production of the soft tin-plate tempers, but not the hard tempers. Continuous annealing is well suited for production of the hard tin-plate tempers, but not the soft tempers. Sufficient work has been done to establish that all the tempers of tin-plate from T–1 through T–6, including T–U can be made by the open-coil annealing of standard tin-plate steels.

Present research on tin-plate at the open-coil pilot plant is being conducted with the objective of developing an open-coil annealing cycle that will eliminate the need or use of rephosphorized steel to make beer-can end stock. If open-coil annealing

can be used to remove the nitrogen from plain-carbon steel and thereby render it non-ageing, it seemed to follow logically that nitrogen could be added to plain-carbon steel and thereby render it harder and stronger. Test results to date have proved that this can readily be done.

Cold reduced black plate made from a normal tin-plate grade of steel (0.08 per cent carbon, 0.33 per cent manganese, 0.009 per cent sulphur, 0.015 per cent phosphorus, and 0.003 per cent nitrogen) has been open-coil annealed, using ammonia during heating to 1,000° F. (538° C.) as the source of nitrogen. Heating from 1,000 to 1,150° F. (538 to 621° C.) and soaking for ½ hour at 1,150° F. (621° C.) in dry 8 per cent hydrogen gas served to diffuse the nitrogen uniformly throughout the thickness of the steel; metallographic examination revealed no nitrided case on the steel. Analyses of samples located at the outside, centre, and inside of the open coil during annealing indicated that the nitrogen content of the coil was in the range from 0.025 to 0.036 per cent. If the strength of the nitrogenized tin-plate is significantly greater than that of conventional beer-can end stock, it should be possible to reduce the basis weight (thickness) of beer-can end stock without sacrifice in the buckling strength and rigidity of the can ends. An extensive open-coil annealing test is presently under way with the newly introduced thin tin-plate.

It seems entirely possible that open-coil annealing will permit the production of all the tin-plate tempers from just one melt grade of steel. For the T–U and T–6 tempers, the nitrogenizing technique described above could be used to obtain 0.015 to 0.020 per cent nitrogen for T–U and about 0.030 per cent nitrogen for T–6. For the softer tempers, T–1 through T–4, the annealing temperature could be varied so as to provide products in the desired hardness range. Since the soaking time is short (½ hour), the rotary-hearth furnace should be suitable for all these annealing treatments, including the nitrogenizing anneals. Also considerable experiments are under way to assess the possibility of avoiding cleaning tin-plate before open-coil annealing and electrolytic coating. The author's company has already accumulated much encouraging experience and an extensive test is now underway at the Wilson pilot plant to gas-clean all common types of rolling oils.

Other Applications of Open-coil Annealing

The work on enamelling steel discussed previously has clearly indicated that the carbon content of plain-carbon steel can be consistently reduced to a very low level (about 0.005 per cent or less) by open-coil annealing. The carbon content of steel with up to about 2½ per cent silicon has also been consistently reduced to this very low level by open-coil annealing. Since the magnetic properties and magnetic-ageing tendency of steel improve as the carbon content is decreased, it follows that open-coil annealing should be well suited for the processing of plain-carbon and low-silicon steel sheets intended for application in electrical machinery, principally motor grades. Cycles are being perfected to achieve during one open-coil annealing the desired decarburization and also the temperature needed to develop the magnetics.

Of the many other potential applications of open-coil "gas alloying", four are of particular importance because, if successful, they would represent major advancements in the processing of flat-rolled steel products. First, there is the possibility of using the principles of gas carburizing to produce high-carbon sheet by carburizing cold-reduced low-carbon steel during open-coil annealing.

Gas carburizing techniques are well developed and case depths equal to half the thickness of sheet steel are common. Significant savings in hot and cold-rolling costs should be realized by eliminating the necessity of rolling high-carbon steel. Second, there is the possibility of making a substitute for chromium grades of stainless steel (for example, AISI Type 430) by diffusing chromium into plain-carbon steel during open-coil annealing in an atmosphere containing gaseous chromium. The advantage and economy in being able to concentrate the chromium content at the surface are obvious. Third, there is the possibility of changing the character and composition of the steel surface by causing it to react with elements and compounds in the annealing atmosphere. For example, surface treatments like phosphating to improve the rust resistance and paintability of steel might be accomplished in this fashion. Fourth, a preliminary decarburizing anneal for continuously-coated galvanized strip makes the product dead soft, which many users of continuously galvanized sheet have desired for so long. This product may achieve wide acceptance from present trends in building auto. bodies.

Summary

The results of experimental work to date on the Lee Wilson Engineering Company pilot open-coil annealing equipment have indicated that the annealing method can be used to produce drawing-quality sheet steels with very uniform mechanical properties. In the experimental work, properties equivalent to those of conventionally box-annealed rimmed and aluminium-killed steels were developed with a soaking time of two hours. Also, it has been found that all the tin-plate tempers can be produced by open-coil annealing of the normal grades of tin-plate steel.

For the most economical annealing of drawing-quality sheets and of tin-plate, a rotary hearth

(*Continued in page* 348)

Open-coil Annealing

(*Continued from page* 347)

furnace with the necessary coiling equipment has been designed.

It has been well established that an enamelling steel, superior to the current standard enamelling steels, can be produced by the decarburizing of normal rimmed steel during open-coil annealing. When the carbon content of rimmed steel is reduced to 0.005 per cent or less by open-coil annealing in moist annealing gas (8 per cent hydrogen—92 per cent nitrogen gas and DEOX gas), the steel is suitable for conventional two-coat enamelling as well as for one-coat or "direct-on" enamelling. It has also been determined that non-ageing rimmed steel can be produced by removing virtually all the carbon and nitrogen from the steel during open-coil annealing in moist hydrogen and in moist 70 per cent hydrogen—30 per cent nitrogen gas.

Results have also indicated that it should be possible to produce T–6 beer-can end stock from plain-carbon steel instead of the more-expensive, difficult-to-roll rephosphorized steel that is currently used. The nitrogen content of cold-reduced low-phosphorus steel has been increased from about 0.003 to 0.030 per cent by short open-coil annealing cycles using ammonia as the source of the nitrogen. The nitrogen is uniformly distributed through the thickness of the steel, and the hardness of the annealed steel is somewhat higher than that of the conventional rephospherized product.

Conclusion

Many of the steel plants who have purchased open-coil annealing equipment have perfected their own cycles to produce superior steels. As steel production has decreased recently in the U.S. and competition for markets has intensified, these companies have not been anxious to disclose either their practices or superior sheet properties to competitors. Hence much of the development, data, and actual performance of the sheets involved are restricted to the individual steel companies.

However, quite positive evidence exists as to the remarkable advantages of open-coil annealing, when one considers the numbers of purchasers of the equipment, which are as follows (up to February 21, 1961):

North American steel plants have purchased 14 such units within the last 2½ years; every one of the eight major U.S. strip producers has bought one or more open-coil installations; nine European strip producers have purchased these units within the last year. The first one started up in March in Italy; three Japanese strip producers purchased this process within the last nine months; twelve more units will start up within the next five months.

The British agents for the Lee-Wilson Co. are The Incandescent Heat Co. Ltd., Smethwick.

I.S.M.E. Discussion

(*Continued from page* 340)

From the back faces of some of the components there appeared to be no incidence of piping at all for extremely thin equivalent discards.

Prof. MAY said that in the example just seen there was a piping effect if the component was not degreased.

Mr. PUGH asked whether this meant that a cone-entry die had been used to inhibit piping.

Prof. MAY said that it was simply a matter of degreasing the surface.

Corrugating Machine

(*Continued from page* 334)

all the corrugations needed for a U.S. Air Force hot-structures research contract, monitored by the Manufacturing Methods Branch, Aeronautical Systems Center, Air Material Command. Height tolerances on the finished corrugations were maintained, when required, to within ±0.003 in.

During forming, a combined clamp and vacuum chuck holds the flat sheet material against one die, aligns the material for each corrugation cycle and picks up and feeds the material. Alignment of the material and movement through the machine are automatic. A sheet of the super-alloy material is clamped between the punch and pressure bar, with tables extended. During forming, the punch and pressure bar move in unison in a downward direction, while the two tables move toward each other, stopping when the desired angle of bend is obtained. Confining metal elongation to the bend area and using only enough elongation to set the formed corrugation produces uniform corrugations with a minimum of material thinning.

At present the width of the corrugated sections is limited to 36 in., though this is arbitrary and the same design principles can be used to build larger capacity machines.

By the use of the machine cumulative dimensional errors, the accumulation of permissible tolerances that cannot be previously predicted, can also be brought into line as they develop, by simple adjustments. Different requirements in corrugation size, shape and material thickness can also be met by changing the relatively inexpensive, removable die inserts. Smaller changes in size and shape involve only simple adjustment of the mechanical stops.

ANISOTROPY AS AN ASSET

for

GOOD DRAWABILITY

By R. L. WHITELEY, D. E. WISE and D. J. BLICKWEDE*

(*A paper presented at the Paris Meeting* 1960, *of the International Deep Drawing Research Group and the Société Française de Métallurgie.*)

CONSIDERABLE effort has been expended over the years to develop a single test or find a single material parameter to evaluate drawability. The variety and complexity of deep-drawing operations has precluded the complete success of this approach, however. A single test often correlates well with some drawing operations, but usually fails to correlate at all with other drawing operations that are not similar in design.

This has led recent investigators to attempt to evaluate drawability on the basis of two distinct tests—one to measure the stretching ability of the metal and a second to measure the true drawing ability of the metal. This paper describes an attempt to define the relationship between these two distinct characteristics of the metal and the more fundamental plastic stress-strain properties which can be measured by the tensile test.

DEEP-DRAWING CONCEPTS

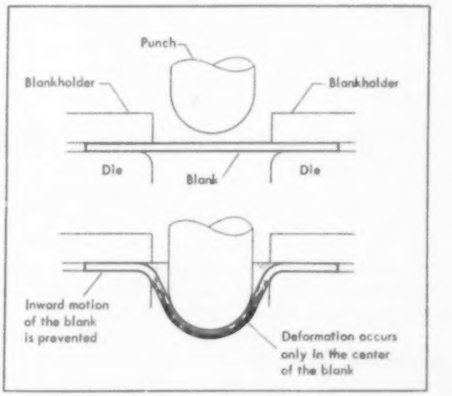
Deep drawing is not a single basic forming process, but rather is a combination of two basic forming processes. For instance, the deep drawing of a cup is achieved by both stretching the metal in the central region of the blank over the punch, and drawing the outer portion of the blank over the lip of the die. This combined stretching and drawing action exists in almost all deep-drawing operations, but not always in the same proportion. The complex interaction of these two modes of deformation has made it difficult to define concisely the fundamental properties of the metal that influence its deep-drawing behaviour.

However, it is possible to define two simple cases of deep drawing that involve only a single mode of deformation. In the forming operation represented by Fig. 1, the deformation of the metal is confined to the central region of the blank lying within the radius of the die lip. The only mode of deformation in this operation is pure stretching†. In Fig. 2, on the other hand, only that portion of the blank lying outside the radius of the die lip is plastically deformed, and the mode of deformation can be classified as pure drawing†. The authors have designated these two very idealized deep-drawing operations as "punch stretching" and "die drawing", respectively. Other authors have made similar distinctions between stretching and drawing, and have pointed out that there is a difference in the ability of a metal to undergo these two types of drawing operations ([1], [2]).

Although the two idealized cases represented in Figs. 1 and 2 can never be fully realized in practice, they do represent the basic components of any deep-drawing system. Even the most complex drawing operations can be envisioned as some combination of these two components. By studying the factors or properties that determine the forming limits of these two limiting cases of deep drawing,

† It is recognized that in both cases some bending must also occur, but its effect is secondary and for simplicity is ignored in the discussion

Fig. 1.—*A schematic representation of "punch stretching". In this ideal drawing operation the mode of deformation is pure stretching*



† Supervisor, Engineer, and Head, Physical Metallurgy Division, Research Department, Bethlehem Steel Company, U.S.A.

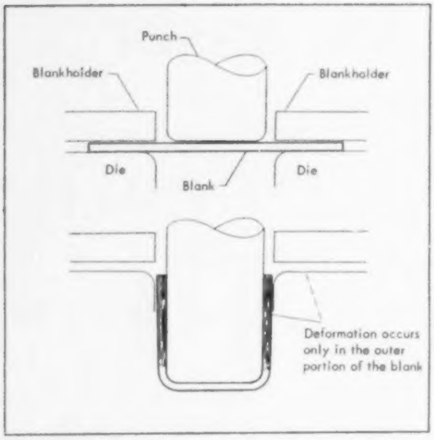


Fig. 2.—A schematic representation of "die-drawing". In this ideal drawing operation the mode of deformation is pure drawing

it is possible to gain some insight of the basic properties that determine the overall deep-drawing behaviour of the metal.

Stretchability

The extent of plastic deformation in punch stretching, as in any pure stretching operation, is limited by the occurrence of plastic instability. Once local necking starts, the blank can be formed no further. The level of strain at which plastic instability occurs depends largely on the strain-hardening capacity of the metal. Obviously the properties of the metal that define its strain-hardening capacity should provide a reasonable measure of its punch-stretching ability.

In general three criteria have been used to define the strain-hardening capacity of the metal—the yield-tensile ratio, the uniform or general elongation, and the strain-hardening exponent. All are determined from a simple tensile test and can be considered as fundamental properties of the metal; and, in general, all give a good indication of deep-drawing behaviour when stretching is the principal mode of deformation.

Drawability

However, strain-hardening properties fail to give an accurate indication of deep-drawing behaviour when the part is formed largely by drawing rather than stretching([3], [4]). The criterion of failure in die drawing is essentially different from that in punch stretching. In die drawing failure occurs when the metal surrounding the punch can no longer support the punch load required to draw that portion of the blank lying outside the radius of the die lip. The amount of deformation that occurs in the metal surrounding the punch is usually incidental to the success or failure of a true drawing operation.

The drawing capacity of a metal can be increased only if the fracture load that the metal surrounding the punch can support is increased relative to the drawing load, which is that required to pull in the outer portion of the blank. Consequently an overall change in the strength of the metal throughout the blank has relatively little effect on its drawing capacity. While the increased strength will allow a greater punch load, a greater load will also be required to draw in the outer portion of the blank. The resultant effect is only to increase both the fracture load and the drawing load. Thus hard metals are often found to draw as well as soft metals.

However, it has been possible to demonstrate mathematically that the fracture load can be increased without increasing the drawing load by increasing the flow strength of the metal in its thickness direction relative to its strength in the plane of the sheet([5]). Thus certain anisotropic metals which are strongest in their thickness direction should have a greater drawing capacity than isotropic metals. Moreover, the parameters which define this particular anisotropy of the metal should also provide a good measure of its die drawing stability.

LABORATORY TESTS

Strain Ratio—R

The plastic anisotropy of a metal can be determined by measuring its strain ratio. This value is the ratio of width to thickness strains measured during the tensile testing of a standard sheet specimen. Several specific techniques for measuring the strain ratio have been described in the literature([6], [7]).

The strain ratio is a fundamental property of the metal and its significance in plastic analysis is analogous to that of Poisson's ratio in elastic analysis. In an isotropic metal, the strain ratio measured in all directions in a sheet is equal to one—any value different from one indicates the metal is anisotropic. A strain ratio greater than one is obtained if the flow strength normal to the sheet is greater than in the plane of the sheet, and less than one if the flow strength normal to the sheet is less than in the plane of the sheet. If, then, a high flow strength normal to the sheet is desirable for good drawability, then the metal with a highest average strain ratio should exhibit the best drawability.

Swift Cup Tests

To determine if a significant relationship exists between drawability and the strain ratio, several metals with widely different strain ratios were drawn on the Swift cup-drawing test*. (With a flat-bottomed punch this test closely simulates the

* The test procedures followed were those outlined by O. H. Kemmis in a review compiled for the Swift Cup-Forming Test Sub-Committee of BISRA. A two-inch flat-bottomed punch was used throughout.

TABLE I—*Summary of Mechanical Properties and Drawability*

Code No.	Material	Drawing Ratio D/d	Strain ratio ϵ_W/ϵ_T	Yield strength lb. per sq. in.	Tensile strength lb. per sq. in.	Elongation in 2 in. per cent	Uniform elongation per cent	Olsen cup test in.	Yield/tensile ratio
1	Killed steel	2.25	1.48	23,200	45,100	36.3	26.0	.406	.51
2	Killed steel[1]	2.30	1.62	14,400	41,400	42.0	29.5	.431	.35
14	Killed steel	2.225	1.64	24,600	43,900	40.6	24.5	.422	.56
19	Killed steel	2.25	1.35	24,600	45,100	40.1	26.0	.415	.55
20	Killed steel[2]	2.25	1.34	27,300	45,600	37.8	23.5	.398	.60
21	Killed steel	2.225	1.40	31,300	44,700	40.6	28.5	.402	.70
34	Killeo steel	2.225	1.54	19,800	42,500	42.2	27.0	.415	.47
38	Killed steel	2.20	1.34	23,700	44,700	40.5	26.0	.407	.53
10	Rimmed steel	2.175	1.01	23,200	38,500	43.6	31.0	.437	.60
11	Rimmed steel	2.15	1.12	31,600	43,600	41.5	27.0	.405	.73
18	Rimmed steel	2.20	1.11	31,300	42,900	41.0	28.5	.416	.73
22-1	Rimmed steel[3]	2.175	1.13	25,700	45,500	39.3	26.0	.426	.57
22-2	Rimmed steel[4]	2.175	1.10	31,300	45,200	36.7	23.5	.397	.69
23	Rimmed steel	2.175	1.30	26,700	44,400	36.4	23.5	.410	.60
24	Rimmed steel	2.20	1.28	24,700	43,000	40.1	24.5	.408	.57
25	Rimmed steel	2.175	1.10	26,900	44,600	39.7	24.5	.405	.60
3	430-Stainless	2.15	1.13	45,000	78,200	25.2	25.0	.335	.58
6	301-Stainless	2.175	.93	43,200	93,900	50.7	50.5	.480	.46
4	2SO-Aluminium	2.10	.65	5,200	13,300	34.6	29.0	.402	.39
5	52SO-Aluminium	2.125	.58	12,800	28,200	25.8	25.5	.329	.45
7	Copper[5]	2.225	.95	12,300	31,300	43.7	43.5	.431	.39
9	65/35 Brass	2.15	.74	38,600	55,500	37.0	27.0	.350	.70
Coef. of correlation			+0.83	—0.12	+0.07	+0.42	+0.04	+0.44	+0.16

Notes—[1]Annealed in wet H_2. [2]Skin rolled—2 per cent. [3]As skin rolled. [4]Aged 43 days. [5]Commercially pure copper

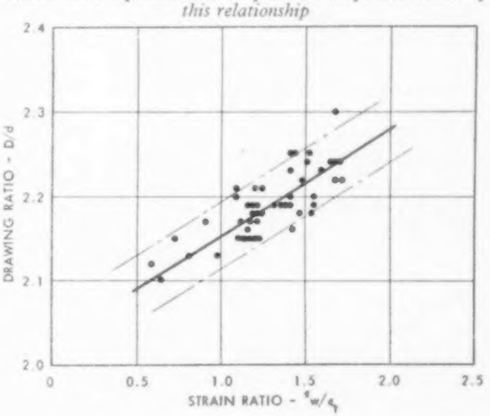
ideal die drawing operation represented in Fig. 2.) Both ferrous and non-ferrous metals were tested, although most were low-carbon steels. In all, twenty-two deep-drawing metals were tested. These metals ranged in yield strength from 5,000 to 45,000 lb. per sq. in. and in total elongation from 20 to 50 per cent. The average strain ratios† of the metals ranged from 0.6 to 1.6 indicating that some of the metals were highly anisotropic. These properties, as well as the drawing ratios measured for all the materials, are shown in Table I.

Considering the extreme range of properties of the metals tested, it is noted that the range of drawabilities as measured by the drawing ratio is not large. The results do show, however, that the metals with highest strain ratios have the best drawability, while those with low strain ratios have poor drawability indicating some correlation between drawability and the strain ratio.

Statistical coefficients of correlation were calculated for the data. These values, as shown in Table I, not only substantiate that the correlation between the drawing ratio and the strain ratio is highly significant, but show that no other property correlates significantly with the drawing ratio. It would appear that all metals would exhibit the same drawing capacity if all were perfectly isotropic.

Recently, additional Swift cup-drawing tests have been carried out on a large number of low-carbon sheet steels of various grades. In Fig. 3 the results of all the tests have been plotted against the strain ratios of the steels. While the results do

Fig. 3.—The relationship between the maximum cup-drawing ratio measured in the Swift cup-drawing test and the anisotropy of the metal as measured by its average strain ratio. The straight-line relationship shown in the figure was established by a least squares analysis of the data. The dashed lines represent the 90 per cent confidence limits of this relationship



† Strain ratios recorded are the average of those measured in several directions in the sheet. The strain ratios in low-carbon steels are generally greatest in the longitudinal and transverse directions and a minimum at 45 deg. to the rolling direction. The degree of variation in the strain ratio at various angles to the rolling direction is an indication of the "earing" potential of the metal with ears normally occurring 90 deg. to the directions in which the strain ratio reaches a maximum. Non-earing steels show little or no variation in the strain ratios measured in different directions.

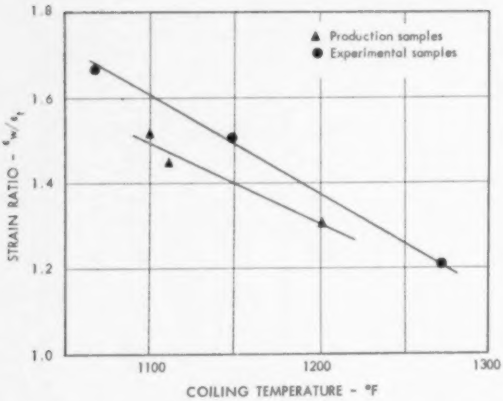


Fig. 4.—The effect of the hot-mill coiling temperature on the anisotropy of aluminium-killed steel sheet as measured by its average strain ratio. The production sample data are based on twenty-four different coils of steel processed according to different standard practices. The experimental data are based on nine coils of steel from the same heat which were given identical processing except for coiling temperature

exhibit some scatter, the correlation between the drawing capacity of the steels and their strain ratio is quite evident. These results indicate that it would not be possible to predict the exact drawing ratio of a given material from its average strain ratio, although one could probably guarantee a particular range of performance. This technique has, in fact, been used to select the size of trial blanks in subsequent Swift cup-drawing tests with considerable success.

PRESS TRIALS

In the introductory statements it was pointed out that stretching and drawing were the two basic modes of deformation in any commercial pressing operation, and their relative influence varies from one operation to another. In spite of this complication it was of interest to test the significance of the correlation between drawability and anisotropy in commercial pressing operations that were predominately drawing in nature. For this purpose a series of steels was prepared with different degrees of both ductility and anisotropy and applied to several drawing operations in order to evaluate their relative performance.

Material

The authors' laboratory tests and reports in the literature[8] indicated that the strain ratio could be controlled in aluminium-killed steels by varying the coiling temperature at the hot mill. This relationship is shown in Fig. 4. Thus, by simply controlling the coiling temperature it was possible to attain different levels of strain ratios in a series of aluminium-killed coils rolled from slabs of the same heat. Different degrees of ductility were attained in the annealed coils by skin rolling either $\frac{1}{2}$, $1\frac{1}{2}$, or $2\frac{1}{2}$ per cent. Thus coils were produced with four different levels of strain ratios, and at each level different values of uniform elongation. Since these steels were aluminium-killed, there were no changes in properties due to strain-ageing to complicate the test results. Except for the coiling temperatures and temper rolling, all coils received identical treatments and were of identical composition. The properties of these coils are shown in Table II.

TABLE II—*Summary of Mechanical Properties and Press Performance of Nine Coils of Specially Processed Aluminium-killed Steels*

Coil No	R_B	Olsen Cup height (in.)	Yield Strength lb. per sq. in.	Tensile Strength lb. per sq. in.	Elongation in 2 in. per cent	Uniform Elongation per cent	Strain Ratio $\varepsilon_W/\varepsilon_T$	Per cent Breakage Case A	Case B
1	40.5	.415	23,500	46,000	38.0	25.0	1.70	0	3
2	45.0	.389	27,300	45,900	38.0	23.0	1.76	2	15
3	49.0	.376	32,700	45,700	36.5	21.0	1.75	5	100
Avg.	(45.0)	(.393)	(27,800)	(45,900)	(37.5)	(23.0)	(1.74)	(2.3)	(39.3)
4	39.0	.413	23,100	44,700	39.0	25.0	1.58	2	67
6	49.0	.389	32,500	46,600	37.7	21.0	1.56	61	100
Avg.	(44.0)	(.401)	(27,800)	(45,600)	(38.3)	(23.0)	(1.57)	(31.5)	(83.5)
9	42.0	.396	26,000	45,700	38.7	23.5	1.46	32	100
5	44.5	.388	28,000	46,100	37.5	22.5	1.44	100	100
Avg.	(43.2)	(.392)	(27,500)	(45,900)	(38.1)	(23.0)	(1.45)	(66)	(100)
7	42.0	.391	29,200	47,400	38.5	24.5	1.16	81	100
8	41.0	.395	29,200	47,100	38.0	24.5	1.17	92	100
Avg.	(41.5)	(.393)	(29,200)	(47,200)	(38.2)	(24.5)	(1.16)	(87)	(100)

Results

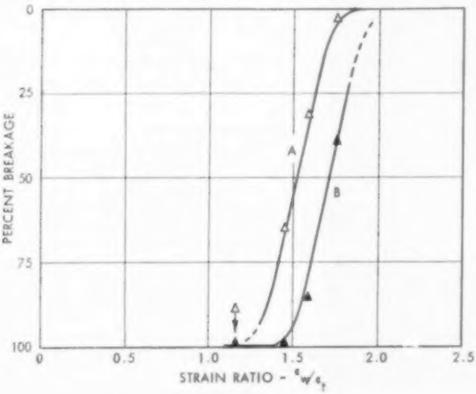
Approximately 200 blanks from each coil were applied to each of several different pressing operations. In all but two of the operations all the steels were formed with no breakage. However, in the two most severe drawing operations breakage was obtained, and the performance did vary significantly for the steels from the different coils. The per cent breakage for the nine steels in these two operations is shown both in Table II and Fig. 5.

In both operations the performance was obviously better for those steels with high strain ratios than for steels of comparable ductility which had low strain ratios. In both cases the strain ratio was the primary factor affecting drawability, although ductility, as indicated by the uniform elongation, was not without effect. This is quite evident in Table II where steels of approximately the same strain ratio have been grouped together. On the other hand, ductility alone does not give even a reasonable indication of the relative performance of the steels in these two particular press operations. Only when both ductility and anisotropy are taken into account is it possible properly to rank these steels in order of their press performance.

DISCUSSION

In the light of the present experimental results it appears that the superior drawing ability of mild steel stems not only from a good strain-hardening capacity but also from a pronounced anisotropy.

Fig. 5.—The effect of the strain ratio on the press performance of nine steels in two different drawing operations. Operation A was the forming of a 9-in. deep square sided vacuum cleaner housing from a 21-in. circular blank. Operation B was the drawing of a complex automobile panel from a 21-in. by 33-in. rectangular blank. The points plotted below are the group averages shown in Table 11 and the curves drawn correspond to steels with a uniform elongation of 23 per cent. Steels with uniform elongations greater than 23 per cent will fall above these curves and those with uniform elongations less than 23 per cent will fall below the curves



Several metals of comparable strain-hardening capacity, but less anisotropic, do not draw as well. Moreover, aluminium-killed steels, which are generally recognized to have superior drawing properties to rimmed steels, are also found to have higher strain ratios indicative of a higher degree of anisotropy. This is clearly shown in Table I. Since both grades of steel have nearly the same strain-hardening properties, differences in their press performance are no doubt due to the diffeences in their anisotropic properties.

Anisotropy in sheet steel can result from either mechanical fibering (*i.e.* rolling out of inclusions or segregates), or from preferred crystallographic orientation of the steel. However, a recent study(*) showed that the type of anisotropy indicated by strain ratios different from one was due to the preferred orientation of the metal and was not a result of mechanical fibering. The authors' studies have confirmed this observation. In particular it has been observed that those preferred orientations that can be roughly described as a cube-on-corner texture produce the highest strain ratios. The two most common textures of this type which occur in mild steels are the (111) [1$\bar{1}$0] and the (111) [11$\bar{2}$].

The attainment of these textures in mild steel has been found to depend on composition, the hot-mill coiling temperature, the degree of cold reduction, and the annealing practice. The superior strain ratios found in the aluminium-killed steels as compared to the rimmed steels can be attributed to the more intense (111) [1$\bar{1}$0] texture observed in the aluminium-killed steels that have been processed to produce an elongated or pancake-shaped grain. The pronounced texture and high strain ratios do not appear to be a consequence of the composition alone, since the same grade of steel produced with equiaxed grain usually has a less pronounced texture and a lower strain ratio. No doubt this is one reason why equiaxed-grained aluminium-killed steels exhibit poorer drawability than otherwise comparable elongated grained steels.

While past efforts toward improving drawability have largely been aimed at improving ductility, it appears that efforts devoted to the attainment of specific types of anisotropy associated with high strain ratios may prove more rewarding. Much work has been done somewhat along these lines in developing improved magnetic properties in silicon steels. It is very possible that some of the knowledge gained in this field may also be applicable to drawing-quality steels.

Conclusions

The results of these studies indicate that the deep-drawing capacity of a metal may be adequately evaluated by means of two parameters obtainable from the simple tensile test. Thus the true drawing

(*Continued in page* 358)

FABRICATING STAINLESS-STEEL BELLOWS

AT the Chesser tube works of Munro and Miller Ltd., at Sighthill, Edinburgh, a wide range of bellows is produced, for use as expansion links in pipelines.

A simple axial bellows has, for example, flanges at each end of the convolutions and is secured simply to the adjoining pipe work. In other forms, however, the bellows may be gimbal mounted or may be provided with hinged restraints in order to absorb internal pressure loading. A particularly impressive form is the articulated bellows developed for duties such as in tanker loading lines, these consisting of two sets of convolutions, separated by a length of tube and restrained by axial restraints.

Bellows have rapidly become accepted as providing many advantages over both loops and sliding glands. As compared with loops, bellows joints accommodate greater movement and require fewer fittings and supports due to their greater simplicity. In addition, this simplicity gives them superior flow characteristics. While sliding glands can accept a greater amount of axial movement than bellows joints, the latter can accommodate lateral and other out-of-balance movements and in addition, provide a packless, leaktight joint.

Absorption of vibration is also an important function of these units and in this connexion they are widely employed with engine exhaust systems in addition to their more common use in power stations, chemical factories, steel plants, distilleries, refineries and production units of all kinds where pipe work is employed under conditions of varying temperature.

(Top).—Post weld finishing with a Consolidated Pneumatic type 5180 Hicycle grinder

(Left).—Welding a mild-steel stub end to a bellows element in 18/8 stainless steel using a Cooper and Turner Diadem Zircon HR2 electrode. Mild-steel stubs are attached in the factory in order to facilitate erection work by ensuring that only mild-steel to mild-steel welds are necessary at site

Each application influences considerably the design of the bellows, some instances requiring closely convoluted units, as in, for example, the range of "Bellex" joints produced to absorb high-frequency vibrations in diesel exhaust pipings, while in others such as those used to accommodate thermal expansion in tankship cargo pumping lines, the number of convolutions per foot is relatively small. Further design complications arise in the materials in which they may be required to be fabricated for duties which may involve such considerations as pressure and corrosion.

While the more standard type bellows are fabricated in various types of stainless steels and are welded to mild-steel flanges for some duties, where corrosion is a particular consideration, fabrication may be in Monel metal. Bellows in this material have been supplied for many uses, one pipe layout handling oil refinery products using 74 bellows in Monel, ranging in size from 20 in. to 48 in. in diameter and accommodating 12 in. of movement with operating conditions in the range 40° to 170° F. at 100 lb. per sq. in. Elsewhere, in the chemical industry 60-in. diameter Monel bellows are used to carry steam containing salts in solution at pressures between 10 lb. per sq. in. and high vacuum while standard bellows in 8 in. diameter manufactured in 12-gauge stainless steel are currently produced for pressures of up to 240 lb. per sq. in. at 20° C. Where higher temperatures and pressures are encountered and where considerable movement has to be accommodated, equalizing rings are fitted to the bellows, these rings having the same contour as the convolutions when fully compressed. The function of the rings is to limit the amount of compression on any one convolution to a certain maximum figure and to transfer the thrust to succeeding convolutions.

In certain cases, where for example, fluids containing solids are being piped, a sleeve may be fitted to prevent solids accumulating in the convolutions. Sleeves are also fitted where the minimum resistance to gas flow is important.

In the development of these bellows and of suitable manufacturing methods, considerable research was entailed, both with regard to the development of suitable materials and heat treatment of these, while a considerable programme of experimental and theoretical stressing was carried out in conjunction with the Heriot-Watt College.

Sequence of Manufacture

The sequence of manufacture starts with the selection of the correct gauge and size of sheet required to form the necessary diameter, this being cut to size, rolled and longitudinally seam welded with an argon-arc automatic welding machine. The resulting tube is then inspected, blanked off, and the convolutions are introduced hydraulically. A feature of this method is the fact that the thinning effect in the convolutions is negligible. By means of heat treatment before and after forming, the maximum ductility is maintained and the process itself exerts a uniformly rising pressure, resulting in steady, plastic flow of the material.

Although automatic welding is used wherever possible in the joining of the convolutions and the flanges and other bellows components, much hand welding is nevertheless necessary, especially where the convolutions have been fabricated in stainless steel while the flanges are of mild steel. In such cases hand welding is carried out using Cooper and Turner Diadem Zircon HR2 electrodes, and it is claimed that the chemical composition of these electrodes provides a barrier which overcomes the tendency towards the migration of carbon from one steel to another and its precipitation as a non-metallic boundary on the edge of a weld under these conditions. This electrode is designed primarily for welding fabrications in such heat-resisting materials as 25 per cent chrome, 20 per cent nickel containing molybdenum, the Diadem variant Zircon HR1 being employed for joining such materials as 23 per cent chrome, 11 per cent nickel with tungsten to such lower alloy steels as the 18/8 type. The weld is made in a single pass and, although the welds are subject to radiography, no metallurgical failure has been experienced with this electrode during the past four years.

Post-weld Treatment

Post-weld treatment includes the grinding and polishing of welded surfaces with Consolidated Pneumatic Hicycle high-frequency electric grinders. The models used are C.P. type 5180 straight grinders and 511AG angle grinders, these being operated from a 12-kVA frequency changer. These tools, by virtue of their high and constant spindle speeds have been found particularly suitable for weld dressing on the many different steels used in the fabrication of the bellows units. For some requirements, as for example, those of the nuclear power industry, semi-clean conditioning is carried out with Hicycle grinders fitted with "Gem" stainless-steel brushes. After further inspection, the bellows are treated with I.C.I. "Trilac" to remove any final traces of foreign matter and are sealed in polyethylene bags.

The bellows are subjected to hydraulic and radiographic tests, these being available for inspection by the inspecting authorities before acceptance. The radiographic section is equipped with a laboratory in which are housed a caesium source and a Fedrex 150-kV gas insulated set, together with developing and illuminated viewing facilities. A mobile Pantak 150-kV set is also available.

QUALITY CONTROL of SHEARED STRIP

New Classifier Equipment Developed by English Electric

A NEW quality control system for the sheet steel and tinplate industries is being produced by the Metal Industries Division of The English Electric Co. Ltd. This new sheet-metal classifier is used for sorting sheared sections of cold strip and rejecting faulty pieces.

Faults such as pinholes, off-gauge and poor surface finish are detected during the inspection of the continuous strip. The sorting into grades can only be done, however, when the strip has been cut into individual sheets.

The sheet classifier stores the information on strip quality obtained at the time of inspection and uses it when the sheet is cut and ready for sorting into piles. The information is stored and processed by Datapacs, standard transistorized logical elements.

From these standard elements a sheet classifier system of any size and complexity can be built, for a line of any speed and with cut length ratio of as much as 10:1. The first units will shortly be installed on number 5 cut-up line at the Abbey Works of the Steel Company of Wales Ltd. and on two cut-up lines at Richard Thomas and Baldwins Ltd., Ebbw Vale. A further unit is to be installed in a South African steelworks.

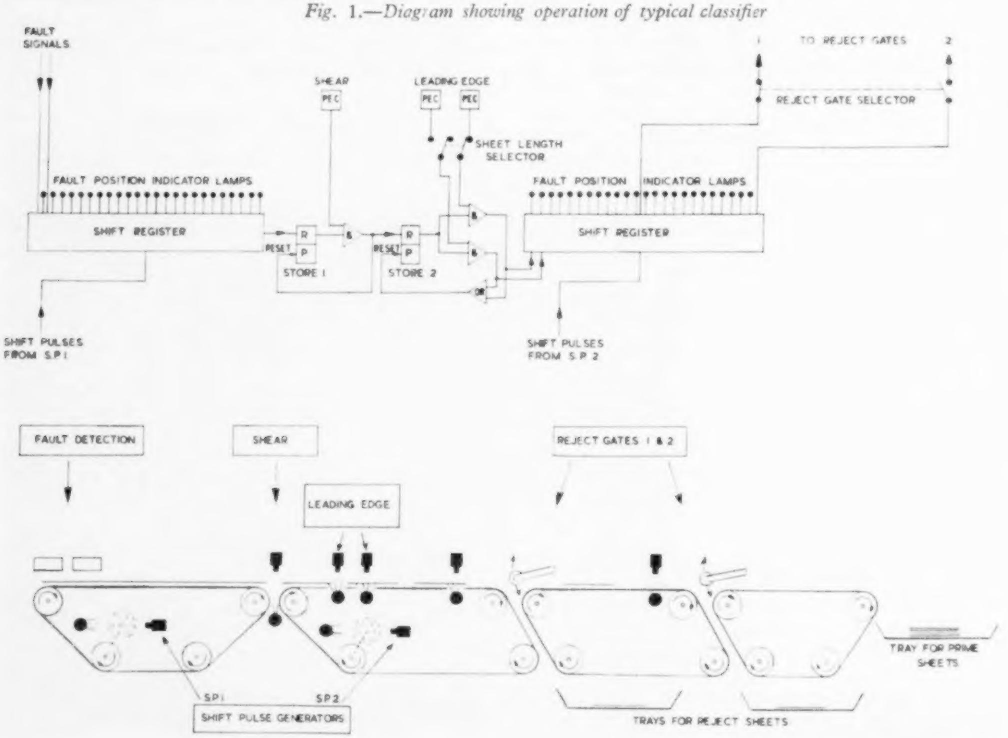
The unit at the Abbey Works will be on a steel line operating at 700 ft. per min. with cut lengths ranging from 40 in. to 180 in. Sorting will be into rejects and prime sheets.

On two tinplate lines at Ebbw Vale, both operating at 1,000 ft. per min. and with cut lengths ranging from 18 in. to 42 in., sorting will be into four piles: sheets with pinholes, off-gauge material, other rejects, and prime sheets.

A simplified working model of this system was shown at the Electrical Engineers (A.S.E.E.) Exhibition, Earls Court.

(*Continued in page* 357)

Fig. 1.—Diagram showing operation of typical classifier



Quality Control of Sheared Strip

(*Continued from page* 356)

The model represented a shearing line with two instruments monitoring strip quality at the entry end, a flying shear and three sheet pilers. On this simple model it was not practicable to shear continuous strip into sheets and this was therefore represented by using previously cut sheets which were placed close together on the first conveyor. The instant of shearing was represented when the sheets passed to the second conveyor; this ran 10 per cent faster, thus forming a gap between the sheets which corresponded closely to the conditions which occur when strip is sheared in practice.

The inspection of the strip was simulated by two reflection photocells which detected shiny patches on the black sheets. Two reject piles were incorporated which in practice would receive faulty sheets detected by the respective instruments. On the model, to keep size and weight within the limits of portability, only one information channel was incorporated and the reject gate in use was selected by means of a switch.

Fig. 2.—Datapac control cabinet for classifier

Method of Operation

The Datapac standard logical elements are in the form of standard plug-in packages. Each package contains a number of elements capable of performing a specific logical function *e.g.* shift register, " and " gate, store etc. Each element can operate from the output of the preceding element so that a series of elements can be made up to form any desired logical system.

Faults detected by the instruments are stored in the first shift register at a point corresponding to the instrument position. Shift pulses timed to the conveyor movement are applied to the register so that the fault signal moves within it in time with the movement of the faulty section of strip on the shearing line. The signal transfers from the register to "store 1" (Fig. 1) when the fault passes the shear position. This then indicates that the next sheet to be cut is a reject.

When a sheet is cut this is detected by a device which causes the signal to be transferred from " store 1 " to " store 2." This indicates that the last sheet cut is reject. The leading edge of this reject sheet is now detected by one of the leading edge detection photocells and transferred to a suitable position in the second register. The signal of the reject sheet is then shifted within the second register so that it appears at a reject gate just before the leading edge of the sheet reaches the gate. The signal is used to prime the gate control to reject the sheet when its leading edge reaches the gate photocell.

Two leading edge photocells are used after the shear to cover the range of sheet lengths used. One is used for short sheets, the other for long sheets. Either is suitable for sheets of medium length. Selection of the photocell is automatically done by the shear cut length setting.

Normally mechanical reject gates are used but more complex methods such as overhead magnetic conveyors with variable drop off points for the piles can be operated with the new system.

Non-Destructive Testing Conference

IN September, 1961, a national conference is being held in Oxford to discuss the function of management in relation to inspection, the economics of inspection and non-destructive testing and the recruitment, education and training of inspection staffs. This conference is being organized jointly by The Institution of Engineering Inspection and the Society of Non-Destructive Examination, and further particulars may be obtained from the Institution of Engineering Inspection, 616 Grand Buildings, Trafalgar Square, London, W.C.2.

GAUGE AND TOOL MAKERS' ASSOCIATION

ONE of the regular trade luncheons of the Gauge and Tool Makers' Association was held at the Savoy Hotel, London, on Thursday, April 20 last, the opening day of the Engineering, Marine, Welding and Nuclear Energy Exhibition. The chief guest was Sir Roger Makins, G.C.B., G.C.M.G., chairman of the United Kingdom Atomic Energy Authority; among the many other distinguished guests were: The Rt. Hon. The Viscount Davidson, G.C.V.O., C.H., C.B. (President of the Engineering Industries Association); Sir Steuart Mitchell, K.B.E., C.B. (Controller of Guided Weapons and Electronics, Ministry of Aviation); Sir Leslie Robinson, K.B.E., C.B. (Second Secretary, Industries, Board of Trade); Sir Miles Thomas, D.F.C., M.I.Mech.E., M.S.A.E. (Managing Director, Monsanto Chemicals Ltd.); A. F. Kelley, B.Sc., A.M.I.Mech.E., A.M.I.C.E., M.I.Prod.E. (Director, Rolls-Royce Ltd.); J. C. Snow (President of the Machine Tool Trades Association);

Sir Roger Makins, after being introduced by the president of the GTMA, Sir Stanley J. Harley, B.Sc., M.I.Mech.E., M.I.Prod.E., said that orders given to members of the GTMA by the UKAEA were often "tall" orders, *e.g.*, manipulators, but this was inevitable in a new industry such as atomic energy. After explaining the various activities of the UKAEA he said that although the weapons were an important and substantial part of their work, the civil applications should not be forgotten. Production of radioactive isotopes, for example, was at a value of about £1¼ millions, of which 60 per cent was exported. The use of these in science and medicine was not sufficiently appreciated and because of this an isotope information bureau had been set up at the Authority's London headquarters.

The toast to the guests was proposed by G. P. Barrott, M.I.Prod.E., chairman of the GTMA, and J. C. Snow, president of the MTTA replied.

Anisotropy as an Asset for Good Drawability

(*Continued from page* 353)

ability of a metal can be measured by means of its strain ratio while its stretchability is measured by its uniform elongation. The parameter that is of greatest importance in practice depends on the specific operation in question. Obviously, it would be desirable to develop steels that have both good uniform elongations and high strain ratios.

Acknowledgement

The authors wish to acknowledge assistance given us by the metallurgical and operating personnel of the Lackawanna Plant of Bethlehem Steel Company during the production of the nine coils of steels used in the press trials. They also appreciate the assistance given us in carrying out the actual press trials by Mr. Homer Pratt of the Fisher Body Division, General Motors Corporation, Dr. Charles Phillips of the Ford Motor Company, Mr. Bram Pais and Dr. Ralph Leiter of The Budd Company, and Mr. Harold Whiteley of Geuder, Paeschke and Frey Company, and their many associates who also contributed to this project.

References

1. Svahn, Olov, "Deep Drawing Properties of Sheet Steel", *Journal Iron and Steel Institute*, May, **177,** pp. 129-142.
2. Guyot, J. and Mercier, P., "Compression in Deep Drawing", *Revue de Metallurgie*, 1958, **55,** (9), pp. 801-814.
3. Beisswanger, H. "The Deep-Drawing Properties of Sheet and Strip as Determined by the Cupping Test", *Metall*, 1952, December, **6,** pp. 744-753.
4. Pearce, R., "A Comparison Between the Swift Cupping Press and the Tensile Test", *Sheet Metal Industries*, 1953, December, **30,** pp. 1077-1080.
5. Whiteley, R. L., "The Importance of Directionality in Drawing Quality Sheet Metal", *Transactions American Society for Metals*, (1960), **52,** pp. 154-169.
6. Lankford, W. T., Snyder, S. C. and Bauscher, J. A., "New Criteria for Predicting the Press Performance of Deep Drawing Sheets", *Transactions American Society for Metals*, 1950, **42,** pp. 1197-1225, and Discussion, pp. 1225-1232.
7. Krupkowski, A. and Kawinski, S., "The Phenomenon of Anisotropy in Annealed Polycrystalline Metals", *Journal Institute of Metals*, 1959, July, **75,** pp. 869-880.
8. Burns, R. S. and Heyer, R. H., "Orientation and Anisotropy in Low Carbon Steel Sheets", Proceedings, International Symposium on Annealing of Low Carbon Steel (1958), pp. 29-41 (Published by Lee Wilson Engineering Company, Cleveland, U.S.A.).

Welding Plastic-coated Steel Sheet

(*Continued from page* 330)

the welding electrode be kept constant? In practice, however, the solution is complicated by the " droopy " electrical characteristics in welding machines and the relatively slow regulating performance of most constant-voltage phase-shift heat control devices. An entirely novel method has been used which has enabled stitch projection welding to be carried out successfully on materials ranging from 26 to 14 gauge p.v.c. backed steel.

The previous critical nature of the operation has disappeared and several new methods are emerging, *e.g.* series projection welding for use where there is no access to the metal face of the laminate (Fig. 1 (*c*)). This method was previously impracticable due to the extremely heavy shunt across the top sheet reducing the effective welding current. The new machine is shown in Fig. 2 and this method has been used successfully in the manufacture of lift cages by H. H. Martyn and Co. of Cheltenham, for welding stiffeners on to the back of Stelvetite panels.

THE BRINSWORTH COLD - STRIP MILL

AT STEEL PEECH AND TOZER

Branch of the United Steel Co.'s Ltd.

A FURTHER stage of the "New Brinsworth Mill" project of Steel, Peech and Tozer (Branch of the United Steel Co.'s Ltd.) for the production of high-quality medium and narrow width steel strip was completed recently. The complete project involved the laying down of a hot-strip mill, pickling, shearing and trimming lines, 4-stand tandem cold mill and a 2-high skin-pass mill. The tandem and skin-pass mills are located in a new building on the far side of the Brinsworth site which is on the east side of the main Sheffield to Rotherham road. The building lies parallel to the hot-mill bays and is divided from them by a roadway and rail track. Material passes through the hot mill in the direction of Rotherham and follows an opposite course through the tandem and skin-pass mills.

One bay of the cold-mill building houses power equipment, control gear and the roll-grinding shop. The second bay houses the tandem and skin-pass mills with their drive motors and the third contains two continuous annealing furnaces.

The four-stand tandem mill is designed to roll mild up to 0.75 per cent carbon steel between 4 in. and 18 in. in width. Maximum thickness of strip received from the hot-strip mill is 0.25 in.; the minimum is 0.048 in. Output thickness ranges from 0.010 in. to 0.160 in. Work rolls on all stands are 10 in. diameter and the back-up rolls 26 in. diameter.

Based on a product 13 in. wide, 0.080 in. thick with the mill working 17 shifts per week of 7½ hours each shift maximum output will be about 2,500 tons per week. Maximum speed from stand 4 is 2,100 ft. per min.

Single or double coils can be rolled with 44-in. and 57-in. outside diameters respectively, the double coils being obtained by butt welding the tail end of one coil to the nose end of another. Special control features are necessary to enable the welded joint to pass through the mill without damage to the work rolls or danger of breaking the strip.

Raw material for cold rolling is supplied from the hot-strip mill, and after pickling, the strip is delivered to the cold mill in coil form *via* a tunnel which connects the pickling plant with the cold-rolling department.

The primary production on the pickled strip is carried out on the Davy-United four-stand, four-high tandem mill. This mill represents the most advanced design of tandem mill of this size, in that Nos. 1 and 4 stands are equipped with Davy-United automatic gauge control, and there is automatic inter-stand tension control between Nos. 3 and 4 stands. During the rolling operation the strip is not in contact with guides of any description, and

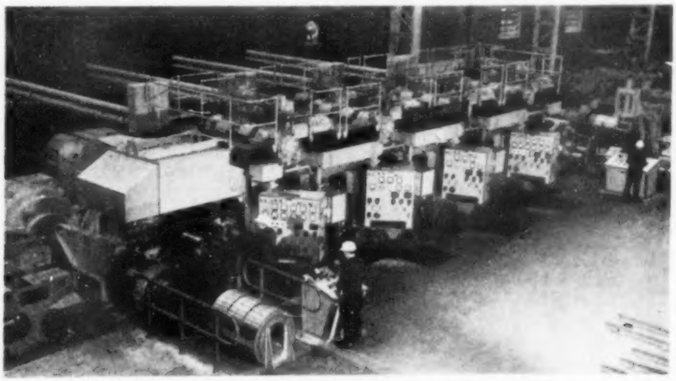


Fig. 1.—General view of the Davy-United four-stand, four-high tandem cold mill at the Brinsworth mill of Steel Peech and Tozer. Stand Nos. 1 and 4 are equipped with automatic gauge control and there is automatic inter-stand tension control between Nos. 3 and 4 stands

maintains its central position in the mill by means of the inter-stand tension, which is infinitely variable. Any deviation in straightness of strip is indicated on the panels attached to each stand, enabling the roller to make the necessary adjustments to ensure production of strip within very close limits of straightness.

The feeding and stripping of the mill has been entirely mechanized and the largest raw material size of 18 in. by 0.25 in. is fed to the mill with no greater effort than that required for the minimum size in the range (4 in. wide by 0.048 in.).

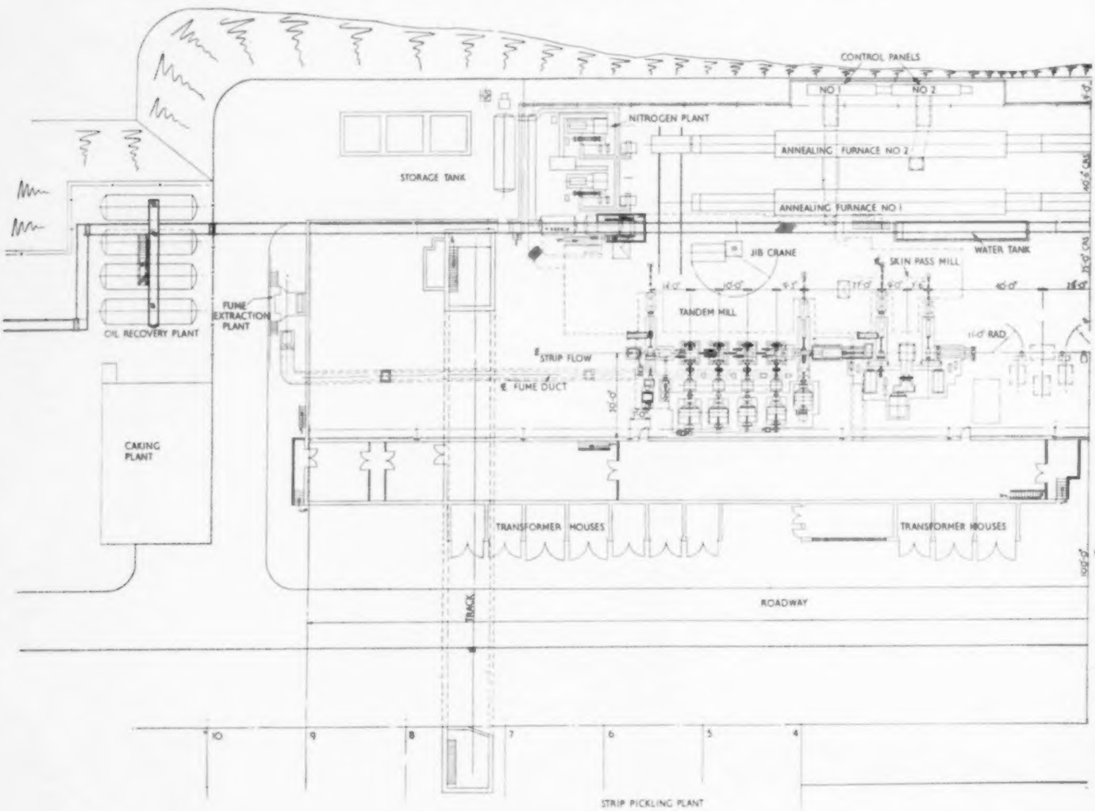
The electrical plant associated with this mill, supplied by the English Electric Co. Ltd., embodies many of the latest developments and techniques in rolling-mill control. The mill motors, having a combined rating of some 4,300 h.p., are supplied from rectifier/invertor units which serve the dual function of powering the mill motors during rolling and returning power to the supply during deceleration of the mill.

All the power equipment for the mill is static and the mill is the first tandem cold mill in the U.K. to be supplied from rectifiers. Mercury-arc convertors are used for the main drives and saturable reactor supplies for the motor fields. Magnetic amplifier control is used throughout; there is a static constant-voltage control supply and static mill-speed reference equipment including static switching. Rotating machinery is only used for the main drives and the high-frequency alternator.

Supervision of the complex of electrical equipment is carried out from a central desk in the motor room into which are built the main controls and instruments. The attention of the maintenance personnel is immediately drawn to any fault which occurs during rolling by an audible alarm and a flashing illuminated alarm, which automatically give the location and type of fault on a mimic diagram.

The rolls are stripped and assembled in a fixed position in the roll shop and serviced by a mobile hydraulically operated table, thereby expediting a operation, ensuring a more precise set-up of bearings

Fig. 2 (below and facing page).—Layout drawing of new Brinsworth cold-mill building



and chocks, and eliminating any shock treatment to the rolls.

Rolls for the mills are ground on a Churchill roll grinder in all finishes up to a mirror finish; after roll grinding, varying degrees of matt finishes can be applied by additional treatment in shotblasting equipment.

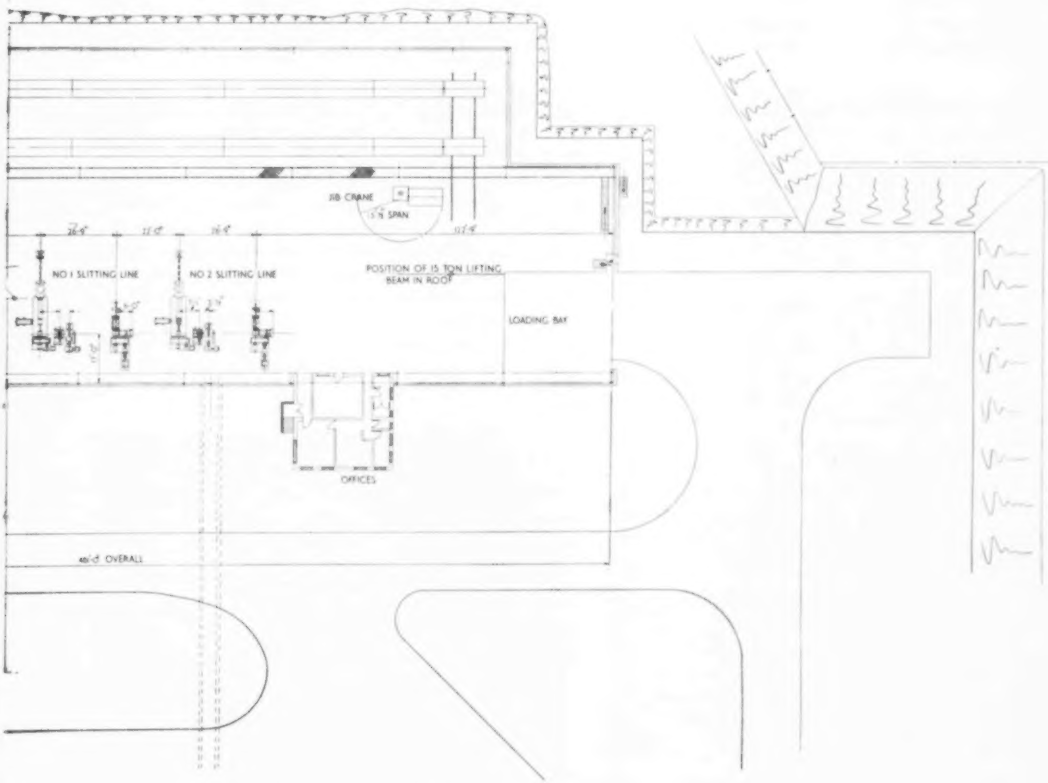
After rolling on the tandem mill, the strip is, with a hardness of about 200 V.P.N., delivered to the annealing department which comprises two 290-ft. long Nasshueur continuous annealing furnaces, built by the International Construction Co. Ltd., each with a capacity of five tons per hour. The coils are fed to a tilting table which positions the coil on a tray, which is then transferred to either of the two furnaces. From the charging of the strip to its exit after annealing, the process is completely automatic. The furnace section of the plant is heated by coke-oven gas, and nitrogen, also obtained from coke-oven gas, is used as a protective atmosphere throughout the heating and cooling zone to eliminate scaling or discoloration of strip surface. The nitrogen plants were installed by The Incandescent Heat Co. Ltd.

The furnace units are designed for single stacking of coils only, resulting in greater consistency of the annealed product, and one furnace has special settings for temperatures, speeds, soaking times, and rate of cooling to enhance the ductility of deep-drawing-quality steels. The annealing temperature is about 710° C.

After annealing, the coils are transferred to a Farmer-Norton two-high temper mill. The feeding and discharging equipment are a duplication of those used on the tandem mill, and the strip is given a varying percentage of reduction to produce strip in the intermediate temper range from skin-passed to three-quarters hard. Coincident with the improvement to the physical properties of the strip resulting from the temper-rolling process, the strip surface can be varied from matt finish to mirror finish according to the surface finish of the rolls.

From the temper mill, the strip is delivered to

Fig. 2 (continued)



the slitting section where the strip takes on its final size in relation to width, inside diameter and coil weight. The two Bigwood slitting machines are equipped with similar feeding equipment to that employed on the tandem and temper mills, but on the recoiling head the strips are kept separately by an overarm separator and are stripped on to a receiving arm where they are finally strapped and labelled ready for despatch. To ensure accuracy of strip width, the slitting heads are assembled as a separate operation in jigs and are transferred to the slitting machine for each change of size.

Each coil is tested after every operation with the requisite testing equipment, dependent upon the physical properties and surface requirement desired in the end product, and for each specification a complete history is kept of the steelmaking and hot-rolling practice and production procedure in the cold-rolling department.

The precision and consistency obtained on all processes in this installation renders the cold-rolled product eminently suitable for use on automatic presses, or where progressive tooling is employed.

Main Tandem Mill Drives

The stand motors are of the English Electric "CS" industrial class specially strengthened for heavy-duty rolling-mill service.

TABLE I
Mill Main Drive Details

Drive	Output	Speed Range	Max. Draft
Uncoiler	25 kW	250/880 r.p.m.	—
Stand 1	1,000 h.p.	168/436 ,,	44 per cent
Stand 2	1,000 ,,	212/551 ,,	41 ,,
Stand 3	1,000 ,,	241/627 ,,	33 ,,
Stand 4	1,000 ,,	291/764 ,,	28 ,,
Coiler	300 ,,	126/440 ,,	—

They are continuously rated, shunt wound, totally-enclosed, forced-ventilated, separately-excited d.c. machines operating on Ward-Leonard control, fully compensated and capable of withstanding frequent working peaks of twice full load with a cut-out peak of $2\frac{1}{2}$ times full load. The motors are direct coupled to the respective mill stand pinions through flexible couplings. Each drives a tacho generator used for speed indication, and in addition, Stand 1 and Stand 4 motors drive pilot exciters used in the control of the uncoiler and coiler respectively. The motors are suitable for forward or reverse inching.

The uncoiler is coupled to a d.c. motor which acts as a drag generator during rolling. This motor is an English Electric CAM type with endshield ball and roller bearings and to compensate for reduction in coil diameter, a speed range of 1:3 by field control is provided. An electro-magnetically released brake locks the uncoiler in position when the motor comes to rest.

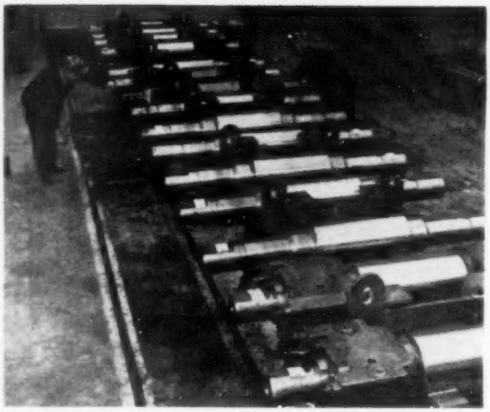


Fig. 3.—A mobile, hydraulically-operated table is used for roll servicing

The coiler motor is similar to the stand motors and also has the field range required for coil build-up. It has forward and reverse inching facilities and is equipped with an electro-magnetic brake. The coiler is a direct drive and overwinds as does the uncoiler but the latter is coupled to the drag generator through a single reduction gearbox of 4.17/1 ratio.

Stand screwdown motors are one-hour rated, compound-wound reversing d.c. motors and there are two motors per mill stand with a 2:1 speed range for rapid roll adjustment. Each motor has an electro-magnetic brake and the drive to the screw-down is by a flexible coupling. There is a magnetic coupling between motors to enable them to be connected or disconnected for individual screw adjustment. The motors also drive a Selsyn transmitter used in a counter circuit.

Mill stand and coiler drive motors are located in the mill bay, and are arranged for up-draught ventilation through a system of underground concrete air ducts.

Power Equipment

Each stand motor is fed from English Electric sealed steel-tank mercury-arc convertor equipments. The coiler motor convertor equipment includes two steel tanks, one connected as a rectifier and one as an invertor, but the uncoiler convertor equipment makes use of single-anode excitron tubes instead of steel-tank units. The screwdown motors for Stand 1 and for Stand 4 also use excitrons convertor equipments. Convertor equipments for the mill drives are housed in a room adjacent to the main control room.

Four-Stand Mill Rolling Procedure

In setting the 4-stand mill for a particular rolling programme the reduction in gauge per stand must

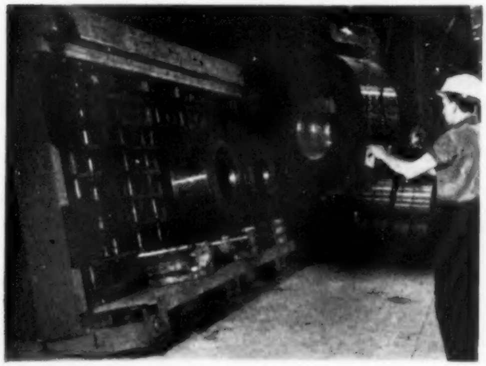
be determined and related to the speed of the stands. The main motor shunt fields and the work-roll screws are then set to calculated values. The new coil is fed on to the uncoiler which has an expanding-type mandrel in the collapsed state. The mandrel is then expanded to grip the coil and the leading edge of the coil is fed under a "tailing" roll and through leveller rolls to the first stand. With strip in the first stand the tension is switched on between the uncoiler and the first stand thus allowing the tailing roll and the leveller rolls to be raised.

For normal operation all stands run at thread speed and the nose end of the strip passes through to the coiler and for all but heavy-gauge material the strip is fed around the expanded coiler mandrel with the aid of a belt wrapper which is withdrawn after the first new turns are wrapped, followed by the application of running tension between the last stand and the coiler. The load on each stand motor and the interstand strip tensions and gauges are then checked against estimated values and fields and screws adjusted as necessary. With the strip in the mill and on the coiler, heavy tensions of up to 15,000 lb. per sq. in. can be applied between stands. After completion of the above operations the mill can be run up to the required rolling speed.

For the heavier gauges the mill is stopped after the nose end has been threaded through the stands. The nose end is placed in a slot in the coiler mandrel by inching the drives after which tension is switched on and the mill run up, first to thread and then to top speed.

Towards the completion of the coil the mill is brought down to thread speed and as the tail end of the strip passes through the mill the coiler drive is stopped, inched to the correct unloading position the mandrel collapsed and the coil removed.

Fig. 4.—Coils of strip are placed on a tray on this tilting table, the tray being charged to either of the two annealing furnaces



Mill Control

The basic operation of the mill is to preset the fields of the individual stands to fit the selected rolling programme. The speed of the whole mill can be raised or lowered by means of a master reference which controls the voltage of all stands to any desired value and mill speed can be raised from zero to maximum at acceleration rates varying between five and 25 seconds.

Speed control of mill motors is by armature voltage from zero to base speeds, and thereafter by shunt field weakening. There are inching facilities, forward and reverse, on all main drive motors and the threading speed is adjustable from 10 to 25 per cent of preset maximum speed. In addition there is fine speed adjustment, very close speed matching of the various main motors, and adjustable acceleration/deceleration time of between 5 to 15 seconds to maximum rolling speed, with accurate maintenance of speed relationship during acceleration, and very accurate and adjustable control of tension on the coiler and uncoiler.

Mill Speed Reference

The voltage setting of the mill for threading and running is determined by a common speed reference to which all four stand controls are connected.

Mill speed setting is obtained by operation of the master run controls (" Thread," " Weld," " Fast," " Hold," " Stop," and " Speed up ").

During entry of the nose end of the strip into the stand the strip may be handled by the operator. A reasonable threading speed must therefore be chosen to allow this. Actual thread speed depends upon the field setting and stand drafting and upon the stands reference voltage, which is adjustable at the last stand cabinet.

When double coils are to be rolled the tail end of one coil is welded to the nose end of the next and during the passage of this weld through the mill the stands run at reduced speed of approximately half normal speed. This is necessary to reduce the risk of damage to the work rolls or breakage of the strip. Weld speed adjustment is made in the control room.

When the " Fast " pushbutton is pressed the mill accelerates up to 100 per cent preset speed at a rate determined by the rise of reference from the reference amplifier. The acceleration rate can be adjusted in the control room between the equivalent of 5 seconds to 25 seconds total time. In practice, the mill is running at thread speed when " fast " is selected. Deceleration takes place at the same rate as acceleration.

During acceleration or deceleration of the mill if it is desired to run the mill at an intermediate speed the " Hold " pushbutton is pressed when the mill is approaching the desired speed. The mill speed will then level out at one of the preset intermediate speeds and hold this speed very accurately for an

Fig. 5 (right).—General view of the two 290-ft. long Nasshueur continuous annealing furnaces built by the International Construction Co. Ltd.

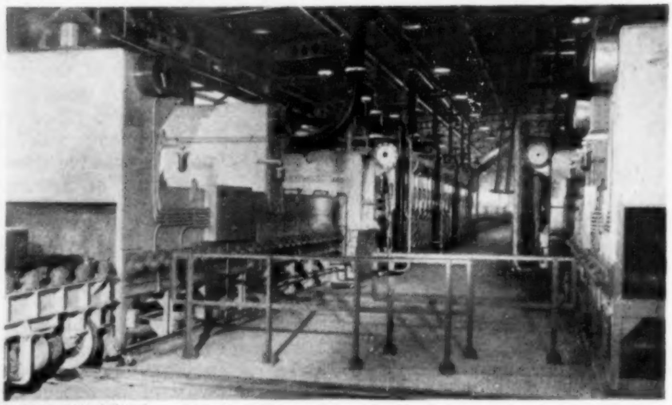


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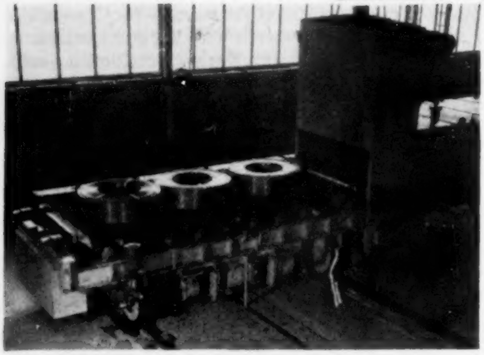
Fig. 6 (below).—Coils in position for charging into one of the annealing furnaces



indefinite period. Further speed changes can be initiated by pressing the thread, fast, or stop pushbuttons.

Dynamic braking is available on all stands, uncoiler and coiler motors but the emergency stop button is used only when normal operational controls have failed to reduce the mill speed.

Pressing the normal stop button at any time initiates deceleration of the mill to rest from the operating speed. A fast controlled stop from maximum speed to rest can be achieved in about 3 seconds. Normally, however, the mill is brought down to thread speed as the coil is being completed and runs at this speed while the next coil is being loaded. Deceleration to thread speed is at a slower rate than for fast stop.

Auto Tension Control and A.G.C.

In a 4-stand tandem mill of this type there are several variables, dependent on the speed of the mill, which are outside the closed loop control. The electrical control is therefore " softened " so that, as the speed effects occur, the change in interstand tension to counteract this effect is not excessive. Speed effect is normally greatest between the last two stands, and therefore interstand tension between Stand 3 and Stand 4 is included in the control system. In addition, automatic gauge control is applied to Stand 1 and to Stand 4 screwdowns.

The control is in three servo systems :—

(1) Gauge by screws ; (2) auto tension, and (3) gauge by tension.

When off-gauge, initial adjustment is by tension control and if off-gauge to a large extent operation of the screws is made. The tension control is faster in response than the screws by about 4:1.

Strip tension is measured by a tensiometer and compared with reference values set by the operator. The error is detected and a correction signal fed into Stand 4 voltage control magamp. If the error is large it causes Stand 4 field setting to be altered. Automatic gauge control also operates into the Stand 4 screwdown control and a permanent correction is achieved by altering the screwdown setting.

Operation of the automatic gauge control will cause the required tension adjustment to be made with the following advantages : adjustment of tension under A.G.C. gives direct correction related to the error signal fed in ; the mill operator has a very sensitive control of interstand tension which can be set directly from the cabinet ; optimum operating conditions are assured by using an automatic follow-on system allowing permanent corrections to be made automatically on Stand 4 field rheostat ; additional voltage capacity is not required for the Stand 4 converter equipment.

Three modes of control are available to the mill operator :—

Manual.—The operator adjusts the field setting to give the correct interstand tension as indicated by a meter on the cabinet which is linked by Selsyn to the screws.

Auto.—Auto tension control in operation.

A.G.C.—Auto tension and A.G.C. circuits connected.

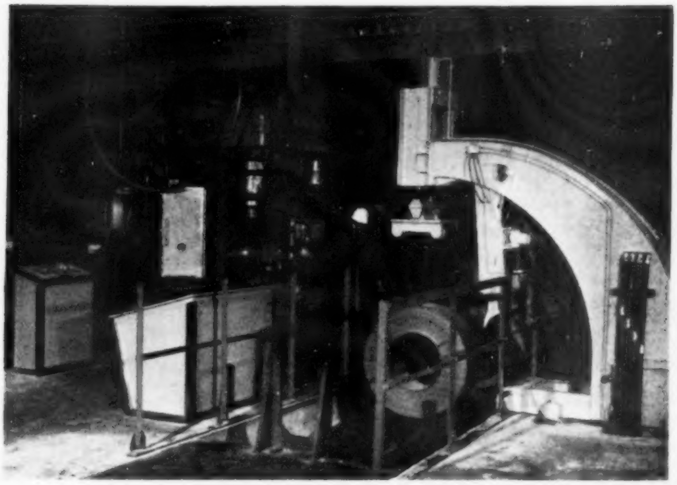


Fig. 7 (left).—General view of Farmer-Norton 2-high temper mill

Fig. 8 (below).—One of the two Bigwood slitting lines

Manual control will over-ride A.G.C. at any time.

Jockey rollers are used to switch Stand 1 A.G.C. on when the strip is in the Stand 2 and off when the strip left Stand 1. A.G.C. is inoperative when the mill is stationary.

Stand 4 A.G.C. utilizes a jockey roller switch and a velocity switch fed from Stand 4 tacho-generators.

A.G.C. operates on the tension control for small fast transient changes, as described above, and on the screwdown control when the gauge tolerance exceeds certain preset limits. Major corrections are best carried out on the first stand and final correction on the last stand. For this reason Stand 1 and Stand 4 screwdown motors are Ward-Leonard controlled. If the error in gauge is large the screws operate at a fast rate; for smaller errors the control of the screws is at a slower rate.

Two systems of applying the A.G.C. signal can be chosen: (*a*) "pattern" control—where stop signals from set points on a potentiometer are compared to the measured gauge signal; or (*b*) variable voltage control—where a continuous error signal is applied directly to the screwdown control magnetic amplifier.

Stands 2 and 3 screwdown motors have a constant voltage supply, the speed of operation being regulated by series armature resistance.

The coiler is required to give tension in the strip as set by the operator; to maintain this preset tension during acceleration, deceleration and throughout coil build up; to give tension at rest to prevent unwinding or throwing of slack, and when using a belt wrapper to run at a speed slightly faster than the strip so as to wrap and tension the first few turns onto the mandrel.

Two basic controls perform these functions. A current control holds tension constant by measuring load current and operating on the converter voltage. A back e.m.f. control operating on the field of the coiler motor makes the motor e.m.f. proportional to the strip speed. With an empty drum this coiler motor speed is high and its field weak, but as the coil builds up motor speed falls and therefore the motor field is progressively strengthened so as to maintain the constant back e.m.f.

Wrap Control.—When wrapping the first few turns on the coiler using the belt wrapper it is required to have the coiler running slightly faster than the equivalent strip speed. Before the strip nose has reached the coiler, the desired tension reference having been set, the coiler motor is prevented from accelerating above the desired speed by a speed limit magnetic amplifier whose output opposes the tension reference.

(*Continued in page* 366)

(*Continued from page* 365)

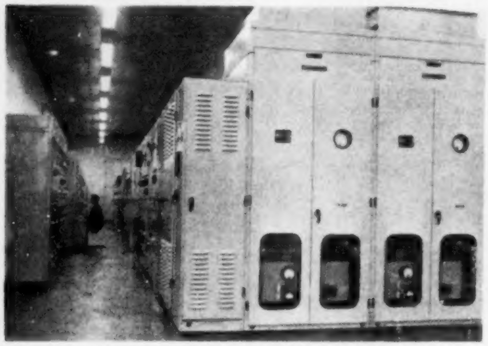


Fig. 9.—General view of part of the English-Electric mill control equipment

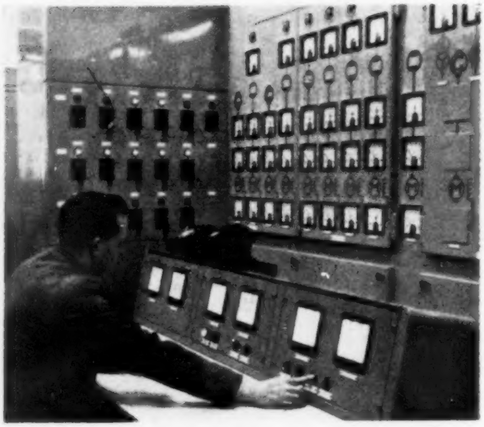


Fig. 10.—The fault-finding panel in the control room. An audible alarm and flashing illuminated alarm give immediate warning of the location and type of any fault which occurs during rolling

As the first few turns are wrapped on the coiler, actual tension is developed in the strip, the "wrap" magamp output decreases and there is a smooth changeover to " tension on."

Uncoiler Control

Tension and e.m.f. controls are basically similar to those provided for the coiler and maintain constant tension between the uncoiler and the first stand in similar fashion to the tension between the last stand and the coiler. During normal rolling, however, the uncoiler operates as a "drag generator" returning power to the system *via* its invertor.

Mill Control Equipment

The uncoiler and coiler desks are floor-mounted but the stand controls are mounted on cabinets attached to the mill housing.

Mill control cabinets are of sheet steel construction with sprayed cellulose finish and stainless-steel beading. They were made of ample size in order to accommodate not only the controls for the main drives but those for coil-handling gear and gauge-control equipment. Because of their size and weight the cabinets are hinged so that, during rolling, controls are conveniently placed for the operators but can be swung out of the way for roll changing and maintenance.

Auxiliary features of the cabinets are the inclusion of sockets for telephone jacks, power plugs for portable tools, chalking slate for screwdown setting, and glove trays. Gear mounted on the cabinets for the gauge control circuit includes: gauge indicators and flying micrometers; loud limit switches; selector switches for A.G.C.; gauge setting switches for A.G.C. accuracy and indication lamps.

There are three single-roll tension meters measuring total tension between Stands 1/2, 2/3 and 3/4. Four tensiometer indicators are mounted on the mill cabinets; Stand 1/2 tensiometer on Stand 1 delivery cabinet, Stand 2/3 meter on Stand 2 cabinet, Stand 3/4 meters on both Stand 3 and 4 cabinets. Load meters are mounted on mill stand cabinets. A selector switch is used so that either the sum or difference of load can be measured. All mill cabinet instruments have built-in illumination utilizing the " light tube " principle.

Control Room Equipment

Control gear for both the 4-stand tandem mill and the single stand skin-pass mill is housed in the control room which is devoid of rotating machinery.

The composite arrangement of some 26 flat-back and cubicle type boards and resistance frameworks led to a considerable economy in interconnecting multi-core cables, connexions between boards being in single-core cable run in overhead trunking.

On a sloping portion of the supervisory desk are mounted illuminated facias giving indication of any fault on the 4-stand mill and the skin-pass mill. The facias are arranged in groups to give identity to both the nature of the fault and its location. Accept, Cancel, and Lamp test pushbuttons are also mounted on the desk.

In front of the supervisory desk is a mimic diagram giving a pictorial indication of the main circuit parameters on both the 4-stand and the skin-pass mills.

Acknowledgements

Acknowledgement is made to Steel, Peech and Tozer, and in particular to the English Electric Co. Ltd., for supplying the information on which this article is based.

THE

ENGINEERING EXHIBITION

OLYMPIA
APRIL 20 TO MAY 4, 1961

In this review of some of the exhibits on show at the Engineering, Marine, Welding and Nuclear Energy Exhibition the emphasis has been placed on equipment displayed for the first time. The exhibition opened on April 20, and this description of exhibits is thus necessarily based on information supplied by exhibitors and available at the time of going to press.

Accles and Pollock Ltd.

Stand No. 47, Inner Row, Gallery, Grand Hall

A live demonstration of new developments in the non-destructive testing of precision tube can be seen by visitors to the Accles and Pollock stand.

For some years, the company have had their own non-destructive testing section doing original work in this field. The results of that development work are now being applied on a production basis, with hundreds of thousands of feet of tube being non-destructively tested every week at the company's Oldbury, Birmingham, works.

The stand at the exhibition shows apparatus using both ultrasonic and eddy-current principles, and demonstrates, by the use of tubes with known faults, how the different techniques can be best applied. Ultrasonics, for instance, is being used to detect a mid-wall defect in a tube with an outside diameter of $1\frac{1}{4}$ in. and a wall thickness of $\frac{1}{4}$ in. Such a fault is readily found by ultrasonic techniques, when a defect at such depth would be difficult to distinguish by eddy-current methods. Eddy-current techniques, however, come into their own on tubes of thin section particularly in smaller diameters, where the severe curvature in relationship to the probe make ultrasonic techniques impracticable. An eddy-current testing set-up, working on 16-gauge tubes with an outside diameter of $\frac{5}{8}$ in. is therefore on show.

In addition to this display of new techniques of non-destructive testing, many examples of new developments in precision tube manufacture and manipulation, including gilled tubing for heat exchangers, flexible convoluted tubing in various forms, honed bore tubes, extruded fuel element cans for nuclear reactors, and a manipulated coil within a coil are being shown.

There is also on display a sample of the smallest seamless tube in the world—made in stainless material, with an outside diameter of 0.000733 in. and a bore of 0.0001 in.

Albright and Wilson (Mfg.) Ltd.

Stand No. 4, Outer Row, Gallery, Grand Hall

This company are showing their range of specialist chemicals and processes, including the new Pyrobrite, and are also featuring their design and installation service covering all types of automatic and manual plant used with their chemicals and processes.

The new Pyrobrite bath for copper plating provides fully bright deposits over a wide current density range. The bath has outstandingly good levelling characteristics and produces close-grained, smooth deposits, which do not fingermark or spot out.

Plusbrite nickel addition agents provide, at low cost, level semi-bright and fully bright nickel plating with notable stability and ease of operation and Plusbrite silver addition agents produce a fully bright, unalloyed, hard and tarnish-resistant deposit, used for plating electrical contacts, engine bearings, decorative table ware and consumer items. Nickel sulphamate and potassium stannate plating is also being featured.

Chemical polishing solutions (Phosbrite) for aluminium, copper and their alloys are fast and inexpensive, producing a bright, highly reflective finish even to the most intricate shapes. Plusbrite 155 and 156 chemical brightening solutions, imparting lustrous, non-specular surfaces to aluminium and its alloys are also being exhibited.

Associated Electrical Industries Ltd.

Stand No. 6, Row N, Ground Floor, National Hall.

In addition to ignitrons for welding applications displayed by the company's electronic apparatus division, there is a range of magnetic crack-detection equipment exhibited by the instrumentation division. Type SA is versatile and is particularly suited to examining large or awkwardly shaped articles. Type CA is a simple general-purpose transportable equipment particularly suited to laboratory and repair shop use where the variety of components to be inspected is great and the speed of testing not of prime importance. Type PM is a small detector whose source of magnetic flux is a permanent magnet of high coercivity and is particularly useful for testing large components that are not easily moved. A feature of Type PM is a shunt control. With the shunt in position the magnetic flux is effectively "short-circuited" and the crack detector can be positioned or removed very easily. The unit is independent of mains supply.

There will also be a demonstration of differential pressure transmitters with both pneumatic and electrical output to show their use in applications

such as remote indication of boiling water level, specific gravity and tank level indication.

Another demonstration is of AEI's ship draught indicator system. By pneumatic means this provides remote indication, at any convenient point in the vessel, of draught, fore and aft trim, hogging, etc., incorporating, if required, specific gravity correction for changes from salt to fresh water.

Also of marine interest is a demonstration simulating remote indication and automatic control at any desired value of pressure in a marine turbine auxiliary exhaust steam range.

Pneumatic instruments for remote indication and control of temperature, pressure, liquid levels, etc., will also be shown.

AEI-Birlec Ltd.

Stand No. 13, *Row E*, *Ground Floor*, *Grand Hall*

A projection room is incorporated into the stand design with seating accommodation for six persons to whom will be shown colour, and black and white, slides of Birlec equipment accompanied by commentaries given by Birlec sales engineers. These slides are projected on to a screen making the illustration visible externally as well as from inside the room. The slides illustrate installations of most types of Birlec furnaces, dryers and gas plants.

A working model of the company's sealed quench furnace shows the complete operating cycle and the latest features on this particular furnace, including the new horizontal radiant tubes.

For those who are users of compressed air interest is centred on the "Autosorber"—a full technical description is available and a facia panel showing its simplicity in operation and ease of maintenance is displayed.

Baldwin Industrial Controls Ltd.

Stand No. 26, *Inner Row*, *Gallery*, *Grand Hall*

A representative selection of fluid power equipment is on show including power cylinders, valves, regulators, lubricators, etc.

On show for the first time at this exhibition is the Baldwin air drill unit, fully powered by compressed air. This unit enables operations such as drilling, reaming, broaching, etc., to be carried out with the utmost speed. The unit comprises three basic sections, the tool holder, drive unit and valve block. Built into the drive unit is a device to allow for fast approach and adjustable feed of the tool holder. The valve unit houses all the necessary controls to stroke and retract the tool holder. Signals are automatically relayed to the next station on completion of the work cycle. Therefore, a number of these units may be coupled together and in conjunction with a suitable indexing work table an automatic sequence may be obtained.

Brockhouse Group

Stand No. 9, *Inner Row*, *Gallery*, *Grand Hall*

Stand No. 11, *Row B*, *Ground Floor*, *Grand Hall*

On Stand No. 9 Brockhouse Engineering are exhibiting a wide range of transmissions, all fitted with torque converter couplings. Stand No. 11, includes exhibits from company's within the Group,

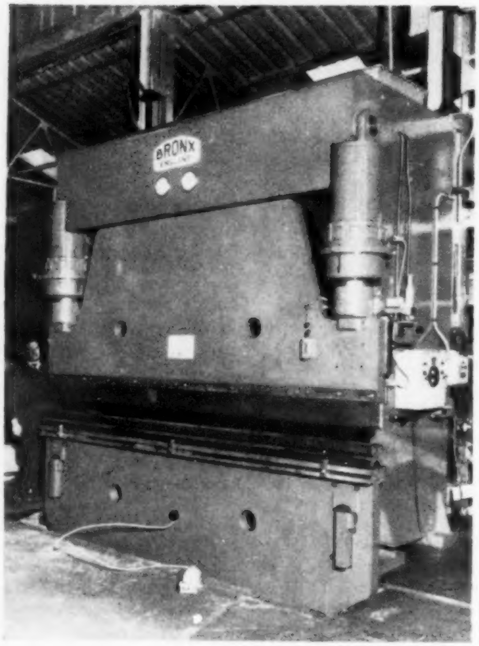


Fig. 1.—*Bronx* 200-*ton electrohydraulic press brake series* 200—8—*H*

e.g., the Warwick Rim and Sectioning Co. Ltd. are showing examples of their cold-rolled section in ferrous and non-ferrous metals.

Bronx Engineering Co. Ltd.

Stand No. 4, *Row A*, *Ground Floor*, *Grand Hall*

Two press brakes are on this stand together with 3-roll pyramid-type plate-bending rolls and a multi-cross tube-straightening machine. One of the press brakes is a hand-operated machine with 8-tons pressure with capacities of 18-g. mild steel over $\frac{7}{16}$-in. vee opening 36 in. long, to 10-g. mild steel over $1\frac{1}{2}$-in. vee opening 10 in. long. The length of the top and bottom beams is 36 in., the stroke of the top beam 21 in., the adjustment of the bottom beam 2 in. and the maximum shut height stroke down, 6 in. The frame is of steel construction comprising heavy one-piece side frames, deep-section front support plate and top and rear cross members all rigidly bolted together. The one-piece deep-section steel-plate top beam carries phosphor-bronze shoes which work on circular-type steel slides mounted on the side frames; the beam is counterbalanced. The one-piece steel bottom beam is mounted on screw-type jacks. Two hand levers are fitted, the long lever for light-gauge material and the shorter lever which operates a ratchet gear for heavy-gauge material.

The 200-ton electrohydraulic press brake, series 200-8-H, also on show has a capacity for bending mild-steel plate 8 ft. wide $\times$ $\frac{7}{16}$ in. thick between the

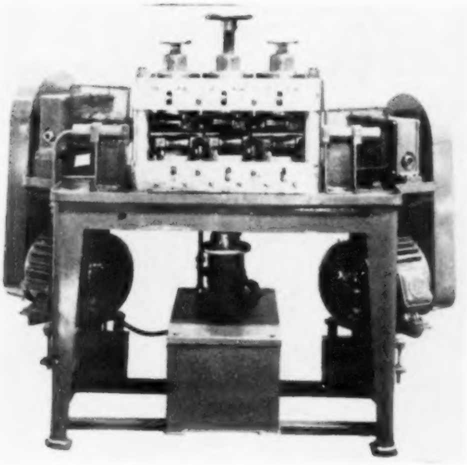


Fig. 2.—Bronx multi-cross tube-straightening machine

frames and 10 ft. wide × [illegible] in. thick overall the beams. The frame is of heavy steel plate construction with deep-section top and bottom beams, the latter being mounted on half-moon pivots and bolted on the centre line of the main housings. The hydraulic cylinders are trunnion-mounted, the hydraulic pump unit and press-control system being manufactured by Towler Bros. Ltd. Grouped selector switches and a pressure control valve give every type of beam control and pressure condition.

The machine can be set for:—

Automatic pressure reversal on reaching any pre-set tonnage.

Indefinite dwell period at any pre-set tonnage with a locked system and pumps completely unloaded.

Variable length of stroke to suit work in hand. Thus a rapid repetition of operation can be obtained using a short stroke cycle.

On all down strokes the press can be inched by direct foot control and the beam wlll stop in any position when the operator takes his foot off the switch.

A selector switch is provided to set the machine for continuous or single stroking operations.

Positive stops are built into each cylinder assembly, and the top beam is adjustable for tool setting by means of a separate motorised adjustment for the ram screws. Built-in counter indicators are provided to assist in tool setting. With this design repetitive air bends can be obtained with the same accuracy as with a mechanical press brake.

Bottoming or coining bends can be carried out up to any pre-determined pressure within the capacity of the machine by setting the pressure control valve to suit.

Castrol Industrial Ltd.

Stand No. 11, *Inner Row, Gallery, Grand Hall*

An important new development in the technique of automatic application of lubricants is represented by the universal centralized lubrication system which is displayed and demonstrated for the first time. Particular emphasis is placed upon the application of this system in the steel industry. Technical literature devoted to this system and to the many other aspects of industrial lubrication is available from the stand.

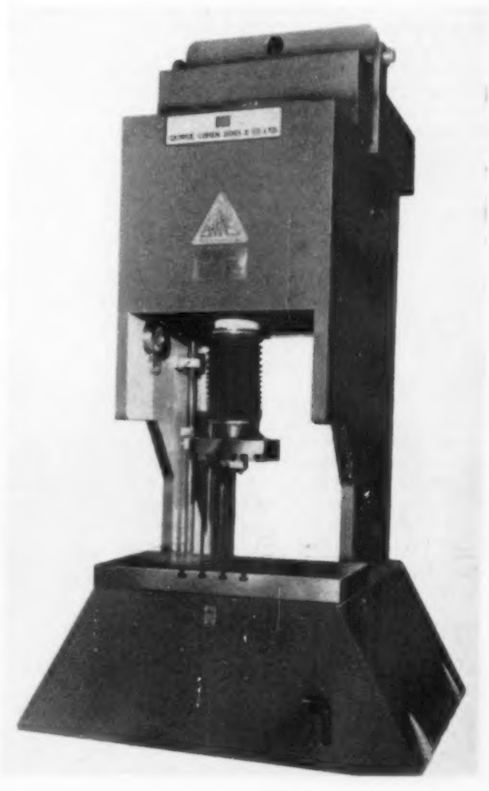
Also prominent on the stand is the company's range of turbine lubricants, including the "Nucleol" series of radiation-resistant lubricants for land-based and marine applications. The company's series of books dealing with lubrication techniques in a wide range of industries are being supplied to engineers upon request.

George Cohen Sons and Co. Ltd.

Stand No. 1, *Row G, Ground Floor, Grand Hall*

For the first time for a number of years the George Cohen 600 Group are represented at the Exhibition, the member company concerned being George Cohen Sons and Co. Ltd., whose sheet-metal working machinery dept. (a part of the company's Machine Tools Division) is displaying a selection of plate working machines for which they act as selling agents.

Fig. 3.—Barnes 100-ton hydraulic down-stroking press (George Cohen Sons and Co. Ltd.)



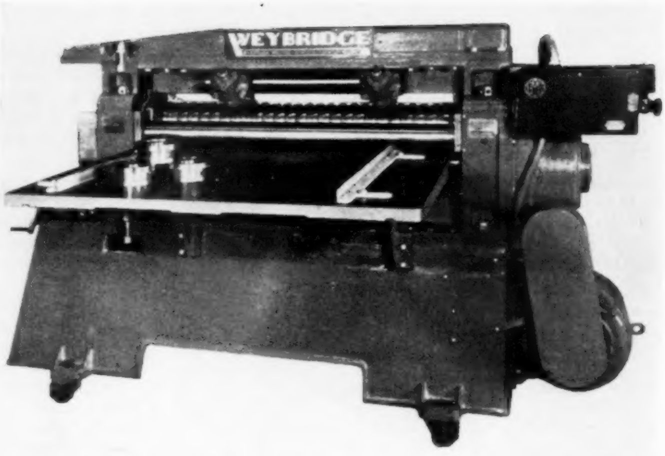


Fig. 4.—Weybridge MS/48 rotary gang slitting shears (George Cohen Sons and Co. Ltd.)

Barnes 100-ton Hydraulic Down-stroking Press

With a rated capacity of 100 tons at a maximum operating pressure of 3,000 lb. per square inch, this new sturdily constructed Barnes press is universal in application, and any thickness of material, within the rated capacity, may be worked without re-setting. The bed area of the machine is 48 in. × 26 in., overall height 8 ft. 9 in; depth from front to back 6 ft. 6 in. and overall width 4 ft. 6 in. The height to the top of the bolster from ground level is 35½ in.

The 4-in. thick bolster is equipped with diagonal tee slots and the centre hole, 7 in. in diameter, is fitted with a removable ring. The maximum admission width between side plates is 36 in. but when equipped with the optional automatic stroking device the maximum width which can be passed through the back is restricted to 32½ in.

With a down ram speed of 35 in. per min. and an up ram speed of 50 in. per min., the independent pressure control valves that are available on approach and return strokes enable a pre-determined stripping pressure to be used if so desired. The automatic stroking device enables a preset length of stroke to be obtained on each cycle, the stroke being variable from a minimum of 1½ in. to a maximum of 12 in. It is also possible to cut out the automatic cycle device to allow for manual control.

The built-in hydraulic pump unit is of the mono-radial type and is driven by a 7½-h.p. motor suitable for 400-440/3/50 supply and running at 960 r.p.m. A large filter is fitted, and the maximum oil reservoir capacity is 75 gallons.

Eldair "Cub" Shears

The cub, as its name implies, is the smallest of the Eldair alligator shears, and has been designed for use where conditions do not justify one of the larger types, with an output far in excess of hand-operated shears. It is of compact fabricated steel construction weighing ¾ ton gross, and incorporates machine-cut steel gearing, a steel-alloy main spindle and bronze bushings to all bearings. The 8-inch long blades have four cutting edges and there is a 2-inch blade opening.

Steco Bending Rolls

The model on display, the LTP 5/DE, is of the pyramid type with a capacity for bending mild-steel plate up to 6 feet wide and ½ inch thick.

The two fixed bottom rolls are 7½ inches in diameter and the adjustable top roll is 8½ inches in diameter. To control the rise and fall of the adjustable upper rolls, separate push-button reversing starter and isolator mechanism, operating through a 3-h.p. motor, is incorporated. Adjusting screws are driven by the same motor via phosphor bronze worm reduction units. The top roll is mounted in swivel bearings to allow for conical rolling and adjustments at both ends can be made either separately or simultaneously.

A special feature of the machine is the drop end bearing which houses one end of the upper roll and remains on the roll journal when the drop end is lowered.

Weybridge MS/48 Rotary Gang Slitting Shears

The MS/48, fitted with 6½-inch diameter cutters, is capable of cutting mild-steel plate up to 48 inches wide and will make a maximum of six cuts in 10-s.w.g. mild steel. It operates at a standard cutting speed of 180 ft. per min. up to 14 s.w.g., and above this thickness up to maximum capacity it is necessary to operate at reduced speeds.

The Weybridge MS/48, which can be fitted with an ingoing feed table, is used primarily for edge trimming and the multiple cutting of sheet for the production of strip, square and rectangular blanks. It has also proved particularly successful for shearing silicon-iron, electrical transformer sheeting.

Powered by a 15-h.p. motor, the machine stands 53 inches overall and 36 inches from floor to table. By the inclusion of a clutch it is also possible to work in conjunction with coiling equipment for certain purposes.

Barnes Hydraulic Upstroking Bending Press

This machine, of all-steel welded-plate fabricated construction, has a capacity for bending steel plate up to 96 inches by ⅜ inch. It is equipped with an automatic cycle device, which means that once a stroke length has been fixed, the machine is then set for batch production with repetitive strokes of equal length. The automatic cycle device works in conjunction with the hydraulic cams and can be disengaged allowing for manual control through a hand control lever.

Maximum pressure is 140 tons and the maximum length of stroke of the hydraulic rams is 12 inches.

Standard equipment includes a top vee punch and a multi vee die block, thus enabling various thicknesses of plate to be bent. Special foundations are not required to install this Barnes press, which has been designed as a composite self-contained unit able to be easily moved from one location to another. It is, however, advisable to place the machine in a 14-inch deep pit to obtain a convenient working height.

Weighing approximately 10 tons overall, and measuring 106 inches long, 108 inches high and 60 inches deep, the machine is powered by a 7½-h.p. motor enclosed in the base.

The Consolidated Pneumatic Tool Co. Ltd.

Stand No. 6, Row C, Ground Floor, Grand Hall

Working demonstrations of a large number of tools from their pneumatic and high-frequency electric ranges, in addition to a static display which includes a number of new items, are the main feature of this stand.

The demonstrations include examples of work carried out by pneumatic and Hicycle impact wrenches and the newly introduced 3008 Magnamatic screwdriver. A demonstration of drilling units includes airfed CP. 327 drills and such light production tools as the 3008, 3017 and 3075 pneumatic drills, in conjunction with Hicycle drills and tappers, while of particular note is the demonstration of the 495 Hicycle drill, mounted on a sliding radial arm. Another new tool being demonstrated is the CP.3017F saw and file, this being demonstrated in conjunction with a pneumatic vice. A grinding section also demonstrates a number of grinders from the range produced by the company, the demonstrations being concluded by a section devoted to sheet-metal working with the new zip gun and Hicycle and pneumatic shears.

The static display on the stand includes two examples of the range of worm gear jacks in addition to a selection of rivetting hammers, aero-hammers, rivet cutters, chipping hammers, rammers, scaling hammers, holders-on, grinders, balancers, drills and Lagonda tube cleaning equipment.

Copper Development Association

Stand No. 7, Row AA, First Floor, Empire Hall

While copper and its alloys readily lend themselves to fabrication by practically every known manufacturing process, the C.D.A., however, have selected two specific examples for featuring on their stand at this year's exhibition.

Extruding—Copper and its alloys are particularly suitable for extruding, and some of the many sections which can be produced by this process are displayed, together with samples of typical components machined, forged or hot-pressed from copper or copper-alloy extrusions.

Welding—An exceptionally wide application of certain copper-base alloys is to be found in the fabrication of heat-exchangers and condensers and where, in most instances, tubes must be welded to tube-plates. Of particular significance in this respect, is a recently developed semi-automatic welding gun, operating on the inert-gas, tungsten-arc process. Each day on the Association's stand there will be given a practical demonstration of the welding of copper-alloy tubes to tube-plates by this method.

One facet of the Association's service to the engineering industry can be seen in the wide range of technical publications, which may be inspected and obtained free upon application.

Members of the staff are in attendance for advice and information on all matters appertaining to the use of copper and its alloys.

Dallow Lambert and Co. Ltd.

Stand 3, Row BB, First Floor, Empire Hall

Dust control equipment, designed and manufactured by Dallow Lambert is represented on this stand. The display consists of the following exhibits :—

MG30 Type A Wet Deduster. This deduster is a standard model in the MG Series of wet dedusters. The range embraces 13 standard sizes from 2,000 cu. ft. per min. to 48,000 cu. ft. per min. and is available with a choice of four principal methods of sludge removal, and is being shown under operating conditions with internal lighting and glass observation panel.

Five dust control units from the "Unimaster" range are on the stand. These units have motorized "air cushion" filter cleaner with push-button control

Fig. 5.—Dallow Lambert "Unimaster" dust-control unit in use (Courtesy of Precision Metal Spinnings (Stratford-on-Avon) Ltd.)

as standard and fully automatic cleaning available as an extra. They incorporate high-performance fans and occupy a small floor area relative to fabric filtration area. The improved fabric filter element can be supplied in a selection of fabrics to suit dust being handled and there are alternative sizes in dust containers with "quick release" mechanism.

Darchem Engineering Ltd.

Stand No. 44, *Inner Row, Gallery, Grand Hall*

This company are precision fabricators of metals and experience gained in the field of specialized welding techniques on light-gauge steel in the aircraft industry, is now being applied to other metals in different industries.

The following are some features of the stand :—

Marine-type Insulation Blanket. This is a section of the marine version of a stainless-steel covered Refrasil blanket used on gas turbines.

Specialized Welding. Examples of work in a range of metal gauges including stainless steel and Inconel, from 0.002 in. to 0.25 in.

Rostenit Lining Process. Examples of welding thin stainless-steel sheet linings to tanks and vessels made of other materials, such as mild steel or concrete. The process is particularly suitable for use in breweries, dairies and chemical plant and the company are sole licencees in the United Kingdom and Ireland.

Stress Relieving Blankets are used in a process providing an *in-situ* service for stress relieving of welded pipes. The unit consists of a circular stainless-steel envelope enclosing layers of Refrasil and Fibreglass insulating materials; the unit incorporates a heating element.

Desoutter Bros. Ltd.

Stand No. 12, *Row J, Ground Floor, Grand Hall*

Of interest on the Desoutter Group stand is the first participation, at an exhibition, of their new company Carter Stevens (Automation) Ltd.

Pneumatic cylinders, control valves and other items of control gear are being shown from Lang Pneumatic Ltd., another member of the Group.

There is also a complete range of Desoutter pneumatic and electric power tools and multiple units for semi-automatic assembly. The die set division are exhibiting a selection of the 2,000 different standardized die-sets available.

The theme of the display is to demonstrate the extent of the service which Desoutter can now provide for industry.

Thos. Firth and John Brown Ltd.

Stand No. 7, *Row Q, Ground Floor, National Hall*

As alloy steel makers, forgemasters, heavy engineers and steel founders, Firth Brown are illustrating a representative range of all their products. These include carbon and alloy steel forgings for marine turbines and transmission gears and power generation, forged steel cylinders, rings and other forgings for aircraft, gas turbine and jet propulsion units and forged steel die blocks.

Their forged steel rolls for the rolling of ferrous and non-ferrous sheet and strip, precious metals, plastic, etc., are supplied in the fully hardened condition up to 36 in. diameter, 17½ tons in weight and back-up rolls up to 56 in. diameter and 45 tons in weight. Rolled steel products are available in the form of black and bright bars for highly stressed parts in the aircraft, motor and the general engineering industries.

The whole of these manufacturing resources are backed by extensive research facilities and these are adequately illustrated in the stand design.

Firth-Vickers Stainless Steels Ltd.

Stand No. 13, *Inner Row, Gallery, National Hall*

The theme of this stand is technical collaboration between producer, fabricator and designer. On display are welded specimens illustrating all techniques that can be applied to the welding of stainless steels.

Alongside the procedures already well known and established, are examples of more recently introduced continuous coated electrode welding together with the latest developments in shielded inert-gas metal-arc welding. Closely linked with the display of welded specimens are illustrations of how automatic welding techniques are used in the production of expansion bellows. In addition to illustrating modern fabricating methods, these show how readily stainless steels respond to these processes.

In the field of new materials, the F.V. 520 steels are being used for an increasing number of applications where their combination of strength, corrosion resistance, and weldability is required. The stand features technical information on these steels together with examples of applications where their use has solved production problems. Other exhibits illustrate how the steels lend themselves to normal methods of fabrication.

On show are parts from a turbo-exhauster where the discs are produced as centrispinnings with the blades subsequently riveted into position. F.V. 520 here provided the required high strength and corrosion resistance that was not previously obtainable in one steel.

A partly produced component on a helicopter gearbox casing shows how F.V. 520(S) sheet material in the softened condition responds to cold manipulation while a further section from this same gearbox casing illustrates how parts can be welded using normal methods for stainless steels.

The stand is planned as an information bureau and throughout the exhibition technical personnel are present to answer questions or discuss problems relating to corrosion and heat-resisting steels and their fabrication.

The Hoyt Metal Co. of Great Britain Ltd.

Stand No. 25, *Outer Row, Gallery, Grand Hall*

This company's range of products includes their well-known anti-friction metals and precision finished plain bearings and bushings in bronze, steel/white metal, steel/copper lead, etc. The display of non-ferrous foundry products comprises phosphor bronze and lead bronze tubes, rods, shapes and castings produced by all the latest methods including the centrifugal and die-casting processes.

The exhibit also includes samples of work produced from press and blanking tools made from the Kirksite "A" metal. This alloy is also in increasing

use as a mould material for plastics, including glass fibre.

The Hoyt Bondmeter Mark I is shown for the first time. This instrument has been specially designed for the non-destructive testing of adhesion (bonding between the white metal and the shell) in bearings lined with one of the Hoyt number eleven group of white metals. It is a sensitive and accurate instrument and the test can be applied 100 per cent to production. The equipment is designed to operate from a 220/240 or alternatively 110 volts a.c. 50 cycle mains. Supplied complete with two pairs of probes, and standard reference sample, packed in a foam-rubber-lined transit case.

Other products exhibited include electrically heated melting pots and ovens, solders, tinning compounds, etc. A wide range of technical literature is available, including "The Hoyt Book on the Lined Bearing". A complete list of all products and service is listed in "Hoyt Buyers' Guide", gratis on application.

Thos. P. Headland, Ltd.

Stand No. 10, Outer Row, Gallery, Grand Hall

Among other exhibits the recently introduced DISONtegrator range of ultrasonic cleaners are on show. These American-built cleaners are in three sizes, ½ gallon, 1½ gallon and 5 gallon with working demonstrations. Available for a variety of cleaning operations dependent upon the cleaning fluid, DISONtegrator ultrasonic cleaners use the cavitation process of submicroscopic bubble formation.

The Gas Council

Stand No. 5, Row N, Ground Floor, National Hall

The accent on this stand is on automation. Gas industry research teams have played a large part in bringing push-button control to industrial appliances and the most recent successes are on show for the first time.

From a control panel on the front of the stand, visitors can light up a forge furnace or start an air heater, one of a range for use in industrial ovens.

Also connected to this centre panel is a packaged conversion burner for process air heaters and other industrial uses. It was developed by the North Western Gas Board's industrial gas development centre at Manchester and is the first British-made gas unit ready "packaged"—complete with fan, automatic ignition and all control equipment. There is also a demonstration unit of the controls used to operate these various appliances.

Another development on show for the first time is a brass billet heating furnace designed by the South Western Gas Board. The furnace can be set to discharge billets automatically at a predetermined rate or singly by the operator pushing a button. This plant is expected to show vast improvements in operation and efficiency over much existing equipment in use in the brass stamping industry.

To complete the stand there is the prototype of a flash melting machine in which the particular qualities of gas have enabled the development of a new process to melt non-ferrous metals far more rapidly and economically than by existing methods. It was developed by the North Eastern Gas Board and has not been previously exhibited.

The automatic brass billet heating furnace is of entirely new design and handles billets three inches long and up to two inches in diameter and is for hot brass stamping. An automatic syntron feeder is fitted and the billets are carried down a vertical furnace which occupies a space of up to three feet square. The furnace can be set to automatically discharge billets at a predetermined rate or singly by the operator pushing a button. Efficiency is high, with maximum operating comfort and high production rates. Industrial Furnaces Ltd. are making the furnace for the South Western Gas Board.

Guest Keen and Nettlefolds (Midlands) Ltd.

Stand No. 14, Inner Row, Gallery, National Hall

The company are showing their wide range of Wedglok screws and nuts, with a special panel exhibiting the high-quality bolts and push rods now made as well as the large number of types of corrosion-resistant fasteners.

The Bolt and Nut Division are showing all types of bolts, including black, bright and high tensile, but in particular, are making a special display of G.K.N. high-strength friction-grip bolts and Torshear friction grip bolts, both of which are well established. In addition, an extension will be made to the range of high-strength friction-grip bolts with a new item which is called the load-indicating bolt. This bolt provides visual indication that a specified minimum tension is reached during tightening. There is also a display of G.K.N. weld nuts, which, when welded on sheets, provide a permanent tapped hole in places where there is difficulty in gaining access.

I.C.I. Ltd. (Metals Division) and Marston Excelsior Ltd.

Stand No. 30, Outer Row, Gallery, Grand Hall

I.C.I. Metals Division and Marston Excelsior Ltd. share this stand and the exhibits are being shown in four main groups—nuclear engineering; titanium; heat exchangers and heat exchange products; and general engineering materials.

In the nuclear engineering section are examples of zirconium, beryllium, hafnium, niobium and other new metals. "Boroplast", a boronized plastic material for use in radiation shields, is included in the display, while Marston Excelsior Ltd, are showing a wide variety of fabrications for nuclear engineering purposes.

With titanium, emphasis is on applications rather than on wrought products. Metal finishing, plant for the chemical industry, and cathodic protection are among the applications being featured.

Included in the section devoted to heat exchangers and heat exchange products, are a cross-section of an aluminium secondary surface heat exchanger with models of a typical installation of such heat exchangers; "Integron" integral finned High-fin and Low-fin forms in copper, copper alloy, aluminium and bi-metal for use in the electrical, petro-chemical, air conditioning and other industries, and roll-welded heat-transfer sheets in Impalco aluminium.

"Portolite" flexible tanks for the transport of liquids are referred to in the general engineering section. Also on display are "Marex" plastic

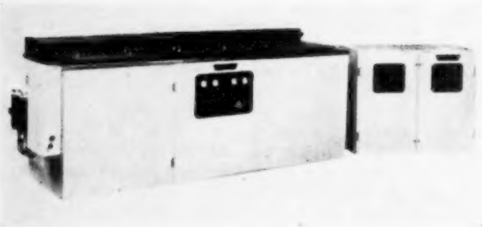


Fig. 6.—Typical 3-stage 4-kW, 40-kc chlorinated solvent ultrasonic cleaning cabinet (Kerry's (Ultrasonics) Ltd.)

laminated fans for removing fumes from chemical equipment, "bursting discs" in a variety of metals and other materials, and Impalco aluminium fishpound boards, stanchions, and lorrybody sections.

I.C.I. Ltd. (Billingham Division)

Stand No. 6, Inner Row, Gallery, National Hall

This stand features the uses of both liquid and solid carbon dioxide in industry, and has as its central exhibit one of I.C.I.'s standard five-ton storage tanks for liquid carbon dioxide. Also prominently displayed on the stand for the interest of the small consumer is a "Drikold" liquefier and a block of "Drikold".

The use of I.C.I. carbon dioxide for shrink fitting, rubber deflashing, welding and the CO_2/-silicate process is described and illustrated on panels. I.C.I.'s role in supplying the nuclear energy industry with liquid carbon dioxide is also stressed, and among other applications of I.C.I. carbon dioxide featured on the stand, is that of "Drikold" as a refrigerant.

The technical service that I.C.I. provides for all customers is emphasized, and technical service staff are present on the stand throughout the Exhibition.

Kerry's (Ultrasonics) Ltd.

Stand No. 10, Row D.D., First Floor, Empire Hall

Ultrasonic cleaning equipment having a cleaning capacity from as small as 1 litre up to 80 gallons is now commercially available. Equipments being demonstrated include bench-mounted and floor-mounted units and information is available on latest developments on the design and installation of semi-automatic and fully automatic cleaning plants.

Equipment is also being demonstrated to machine ultrasonically hard and brittle materials such as glass, ceramics, tungsten carbide, minerals, precious, semi-precious stones, quartz, germanium, silicon, etc., The equipment uses ultrasonic generators with output powers of 60W and 500W with machining capacities from a few thousands of an inch diameter, up to two inches diameter.

Martonair Ltd.

Stand No. 24, Outer Row, Gallery, National Hall

A very wide range of pneumatic equipment is being exhibited on this stand.

The provision of work at a convenient height to the operator can do much to reduce fatigue, and the "tray lift" displayed is intended to raise or lower tote boxes or trays of components. A pair of lifts, one for supply and one for finished parts, is the normal complement per machine. A rugged steel platform is raised or lowered by single-acting pneumatic cylinders controlled by twin push-buttons, enabling the operator to adjust the level as boxes or trays are emptied or filled. A bayonet coupling is provided for connexion to the normal shop airline.

The alliance of hydraulics and pneumatics provides many advantages, particularly where the flexibility and low cost of pneumatic equipment is used in conjunction with low pressure hydraulic cylinders. A display panel illustrates the principles involved in hydro-pneumatics, and includes devices for raising and lowering stacks of material so that the top of the stack returns to a constant level when components are added or removed.

Martonair Impact Cylinders are designed for use with standard valve equipment, and are supplied with capacities of 1/10 to 2 ton-inches. The one ton-inch capacity model is suitable for delivering a maximum blow of 20 tons. At 80 lb. per sq. in. air supply, this unit will at a single blow punch a 1-in. diameter hole in a $\frac{1}{4}$-in. thick mild steel plate. The return thrust is approximately 2,000 lb. at this supply pressure. Speeds of 30 blows per minute are easily obtained.

These units are suitable for all types of press work, *e.g.*, punching, crimping, riveting, piercing, pressing, cropping, coining, forming, impact extruding; sizing, marking, etc.

The unit may be built-up as a press, built into existing machinery, or adapted for additional subsidiary operations to existing presses and may be used to convert fly and kick presses, etc.

The impact blow delivered may be readily varied to suit different applications by incorporating a standard type air pressure regulator which will give direct control. The construction of the units is extremely simple and robust, and due to the cushioning effect no stress due to the blow is placed on the cylinder or cylinder mounting due to incorrect operation.

The operation can be likened to a "drop or sledge hammer" type blow. The final piston rod and piston assembly speed is extremely fast, being in the region of 25 feet per second.

Metallisation Ltd.

Stand No. 10, Row K, Ground Floor, Grand Hall

A new hardfacing technique is being demonstrated on this stand.

The practice of hardfacing with Stellite is well known and the conventional techniques of application by gas and arc welding provide perfectly satisfactory hardfacing deposits of over $\frac{1}{16}$ of an inch in thickness. When it is necessary to apply thinner coatings the results may not be as satisfactory owing to dilution of the overlay by the parent metal. Furthermore, components of thin wall section often suffer severe distortion when subjected to the welding processes. For this reason extensive research was carried out to develop a suitable application process for materials having equivalent properties. The outcome of this research was the introduction to the range of Stellite alloys (SF. 6, SF. 12, SF. 1) in rod form which can be readily applied by the Metallisation Mark 33 metal spraying pistols.

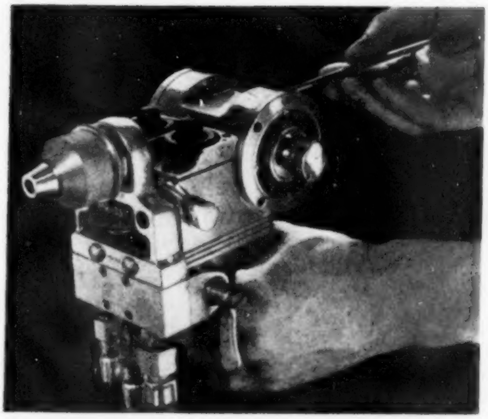


Fig. 7.—Metal-spraying pistol for spraying Stellite alloys in rod form (Metallisation Ltd.)

The deposits so applied exhibit the typical structure of sprayed metals but by means of a subsequent fusing operation they are converted to a homogeneous overlay metallurgically bonded to the parent metal. Deposits produced in this way have little variation in thickness and thus demand the minimum consumption of materials and grinding time for finishing.

The bond is formed by a diffusion mechanism and analysis shows no detectable increase in iron content even at a distance of 0.006 in. from the junction. The rod spraying process is fast and requires a minimum of operator's skill.

Stellite (cobalt-based) alloys have already been produced in Grades SF. 1, SF. 6 and SF. 12 and rods of other hardfacing alloys will be shortly available. These special rods are manufactured by Deloro Stellite Ltd., and are obtainable with equipment from Metallisation Ltd.

Stellite Sprayflow deposits are alloyed to the base material by heat treatment after spraying and their structures are quite different from normal sprayed metals which are mechanically bonded.

The process is carried out in three stages :—
1. Preparation. 2. Spraying. 3. Fusing.

The first two operations follow general metallizing practice and the importance of the third operation of fusing cannot be over-emphasized. During this operation not only is the deposit metallurgically bonded to the base metal but the deposit itself is transformed from a porous, sprayed condition to an impervious continuous overlay. The Sprayflow method is one most suitable for the deposition of thicknesses in the range of 0.010 in. to 0.060 in. (0.254 mm to 1.524 mm). Generally oxy-acetylene and electric arc welding processes are used where deposits in excess of $\frac{1}{16}$ in. (1.58 mm) are required.

METCO Ltd.

Stand 10, *Row A*, *Ground Floor*, *Grand Hall*

Of special interest is the METCO plasma flame spray gun being exhibited for the first time in this country. Plasma now makes it possible to deposit as a coating, many types of metals, refractories and oxides previously denied research and design engineers. Materials that can be sprayed include chromium, cobalt, molybdenum, tungsten, chromium carbide, tungsten carbide, rare-earth oxides, titanium oxide, calcium zirconate and in fact most materials that do not decompose when melted. These materials, applied with the Type MB plasma flame spray equipment, give a dense coating and a high degree of bond to the base metal. The equipment has been designed for development work in the jet and rocket motor fields, missile work, nuclear and electronic industries and research work into applications involving the use of these high temperature materials.

The METCO stand is also showing the more "conventional" metallizing and ThermoSpray hard facing processes. Both wire and powder spraying are being demonstrated and examples show the application to items such as rolls, crankshafts, journals, gauges, cylinder bores, shafts, etc. Bulletins describing all the flame spray equipment exhibited are available to visitors who can have any questions answered by the technical services staff in attendance.

Pearson Machine Tool Co. Ltd.

Stand No. 13, *Row H*, *Ground Floor*, *Grand Hall*

Three examples of their electro-hydraulic machine tools are being shown by the company on this stand.

The 300-ton flanging press, 14 ft. 3 in. over the bed, is of the latest type with power return of ram, and up and down stroke limitation, the latter with micro-setting.

Of interest to all shipbuilders and heavy steel fabricators is the newly introduced bevel shear, which provides facility for cutting at any angle from 0 deg. to 35 deg., and also variable blade rake. This machine, of proved design, has been developed for simple and rapid plate edge preparation for welding, and the guillotine shown is of 10 ft. × 1 in. capacity in mild steel.

The third exhibit on the stand is an example of the Pearson hydraulic power pack, a compact unit embodying the company's multi-cylinder radial pump, control valve, adjustable relief valve, pressure gauge and oil tank. The varying sizes of this power pack provide sources of hydraulic power at pressures up to 4,000 lb. per sq. in. and deliveries ranging from 4 to 38 gallons per minute.

Henry Pels and Co. Ltd.

Stand No. 1, *Row E*, *Ground Floor*, *Grand Hall*

Two machines are being shown for the first time *viz.*, a universal steelworker (Type MKC 10) and a multi-purpose, open-ended shear (Type FB 13). The steelworker will punch $\frac{13}{16}$ in. dia. through $\frac{3}{4}$ in. thickness and will also shear $\frac{3}{4}$-in. thick mild steel. The notching capacity is, square $\frac{3}{8}$ in., and mitre $\frac{5}{16}$ in. The cropping capacity is : angles and tees 3 in. × 3 in. × $\frac{3}{8}$ in. ; rounds, $1\frac{1}{4}$ in. ; and squares $1\frac{1}{8}$ in.

The Pels multi-purpose open-ended shear, Type FB 13, has been designed primarily as a heavy-duty machine for cutting flats up to 20 × $\frac{1}{2}$ in. at one stroke. This capacity can be continuously cut with a 2 deg. raked blade, without any deformation of the

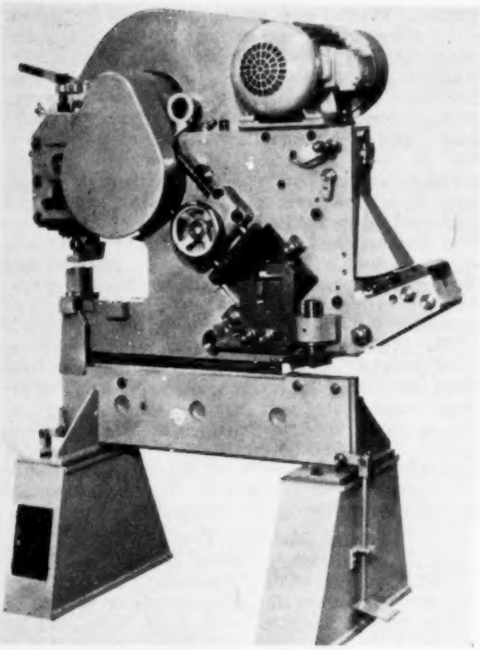


Fig. 8.—Type MKC 10 *universal steelworker (Henry Pels and Co. Ltd.)*

offcut. The amply proportioned, welded box construction of the frame gives the necessary strength and rigidity for this work.

The machine can also be supplied in a modified form, Type FB 13 sp. with a $14\frac{1}{2}$ in. blade length, when with a 5 deg. raked blade it will cut flats up to $14 \times \frac{3}{4}$ in.

The standard shearing arrangement can be quickly stripped out, leaving a flat table and a simple stepped seating in the slide above. The machine can then be used for a wide variety of operations.

The frame consists of two rolled-steel plates welded with spacers into a rigid box structure which is virtually unbreakable.

The flywheel is of solid, compact design mounted on a shaft running in heavy roller bearings and driven from the motor by multiple vee belts. It may be turned over by hand for tool alignment simply by removing the inspection cover on the guard. The machine has two-step gear reduction.

The clutch is of the 3 jaw type consisting of a housing which, when released, moves forward and engages with the jaws on the main gear.

The upper shear blade, which is raked on its lower cutting edge, bolts directly into the slide. The rectangular lower blade is bolted into a holder secured to the table and adjustable when blade setting or to take up wear after regrinding.

The standard shearing downholder is of the hand adjusted, double spindle type with a plain clamping bar allowing maximum vision when cutting to a line. This standard unit can, however, be detached and any alternative type from simple clamping screws to an automatic device be fitted.

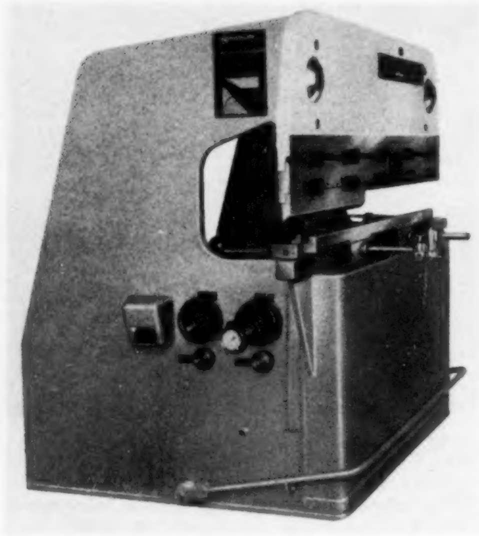


Fig. 9.—Promecam hydraulic press brake (Press and Shear Machinery Co. Ltd.)

Press and Shear Machinery Co. Ltd.
Elgar Machine Tool Co. Ltd.

Stand No. 15, *Row J, Ground Floor, Grand Hall*

A wide range of sheet-metal working machinery is being exhibited on this stand, by Press and Shear, including presses, press brakes, nibbling machines, shearing machines, etc. As the number of exhibits is large brief details of each is given below.

*Rushworth, Model R.*50/6. All-steel mechanically-operated press brake. Maximum pressure 50 tons, working capacity 6 ft. $\times \frac{1}{4}$ in., die surface 82 in., distance between frames 73 in., stroke $2\frac{1}{2}$ in.

*Promecam, Model RG.*25. Hydraulically-operated press brake with upstroking bending beam. Maximum pressure 25 tons, working capacity 3 ft. 6 in. × 14g. (nominal), die surface 3 ft. $11\frac{1}{4}$ in.

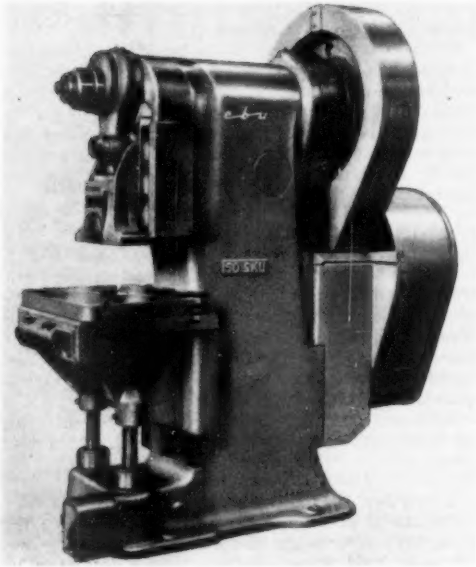
*Promecam, Model RG.*50. Hydraulically-operated press brake with upstroking bending beam. Maximum pressure 50 tons, working capacity 6 ft. 6 in. × 10g., die surface 6 ft. $6\frac{3}{4}$ in.

Grabener, Model 100. Knuckle-joint embossing press. Maximum pressure 100 tons, maximum distance between work holding block $11\frac{13}{16}$ in., 70 s.p.m.

Bruderer, Model STA 20/18. Swiss-built high-speed precision punching press with strip feed. Capacity 18 tons.

EBU, Model 75*R.* Geared eccentric press with adjustable table and rolling-key clutch. Capacity 75 tons, bed area $31\frac{1}{2}$ in. × 24 in.

EBU, Model 50 *SKU.* Two-speed eccentric power press with adjustable table, and electro-pneumatically-operated friction clutch. Capacity 50 tons ; bed area $25\frac{1}{2}$ in. × $20\frac{1}{4}$ in.



Muller, Model CE 40 Z. Electric oil-hydraulic single-column drawing press. Effective pressure ram head 44½ tons, draw die pressure 18 tons, table size 22 in. × 22 in.

Elmeg, range of Electromagnetic Presses. Four models ranging from 22 lb. pressure to 3½ tons pressure. Variable strokes and pressures are obtainable on all models.

Peddinghaus, Model 210/16. *Universal Steel Worker.* Shears plates up to ⅝ in. angles 90°, 6 in. × 4 in. × ½ in., Tees 90°, 5 in. × 5 in. × ½ in., punches 1 1/16 in. × ¾ in. or ⅞ in. × ⅞ in.

Peddinghaus, Model 210/13. *Universal Steel Worker.* Shears plates up to ½ in., Angles 90°, 4 in. × 4 in. × ½ in., Tees 90°, 4 in. × 4 in. × ⅜ in., punches 1 in. × ⅝ in. or 13/16 in. × ¾ in.

Peddy Shear with Rotary Table. Complete with notching attachment. Shears plates up to ⅜ in., Angles 90°, 2¾ in. × ¼ in., Tees 90°, 2⅜ in. × ¼ in., Punches 9/16 in. × 5/16 in.

*BMB, Model NA.*1000. *Universal Nibbling and Shearing Machine* with co-ordinated table. Capacity ¼ in., forming capacity ⅛ in., stroke 0-⅜ in. Capable of circle cutting, peening, beading, flanging, folding and louvring.

*BMB, Model NA.*1200/9. *Universal Nibbling and Shearing Machine* with co-ordinated table. Capacity ⅜ in., forming capacity 5/32 in., stroke 0-⅜ in. Capable of circle cutting, peening, beading, flanging, folding and louvring.

Ste-Co, Model LTP/DE. Power operated Bending Ro'l with Drop End, with power-operated top roll. Capacity 72 in. × ½ in.

The Pyrene Co. Ltd.

Stand No. 17, *Inner Row, Gallery, National Hall*

The theme of the company's Metal Finishing Division stand this year shows how their Bonderizing and Parkerizing phosphating processes help industry "from start to finish", *i.e.*, at the initial manufacturing stages of steel parts and in their final finishing treatments.

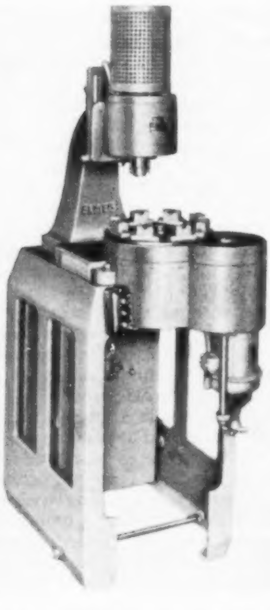
Part of the exhibit is devoted to the use of Bonderizing in the cold forming field, *i.e.*, for assisting wire drawing and tube drawing and the use of Bonderizing/

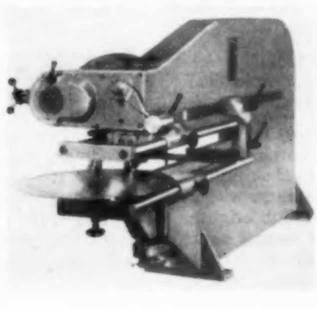
Fig. 10 *(above).—One of the range of EBU presses (Press and Shear Machinery Co. Ltd.)*

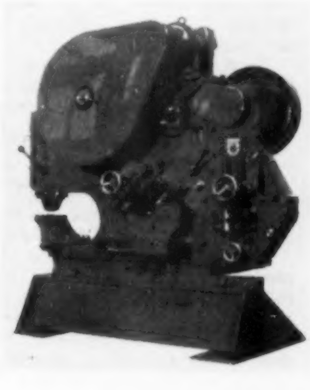
Fig. 11 *(left).—One of the range of Elmeg electromagnetic presses (Press and Shear Machinery Co. Ltd.)*

Fig. 12 *(below).—BMB universal nibbling and shearing machine (Press and Shear Machinery Co. Ltd.)*

Fig. 13 *(below.)—Peddinghaus universal steel worker (Press and Shear Machinery Co. Ltd.)*







Bonderlube for aiding the deep drawing and cold extrusion of steel. Photographs of typical plants and examples of formed parts are displayed.

The other section of the stand is devoted to the use of phosphate processes for finishing components and shown here are: Bonderizing as a base for paint, Parkerizing as a rustproofing finish and Parco lubrizing for wear resistance.

An incidental display shows the use of Pyrene Bonderite chromating processes for increasing the bare corrosion resistance of galvanized parts with particular reference to the prevention of "white rust". This is demonstrated by showing untreated and treated galvanized tubes.

Also displayed are the new "Parker" Finishes P45B and P45C. These are quick air-drying materials for use after Bonderizing or Parkerizing, giving maximum adhesion and corrosion resistance.

Rushworth and Co. (Sowerby Bridge) Ltd.

Stand No. 5, *Row K, Ground Floor, Grand Hall*

Featured on this stand is the model 838 guillotine, a high-speed machine of fabricated steel construction, with ample gaps in the side frames. The drive is by worm gearing, the motor and flywheel being coaxial with the worm shaft. This machine has a capacity of 8 ft. × ⅜ in. mild steel and operates at 50 strokes per min. The slide carrying the top blade moves downwards and backwards simultaneously during the cutting stroke; the bottom blade is mounted on a block adjustable over its full length.

Smiths Industrial Division

Stand No. 31, *Inner Row, Gallery, Grand Hall*
Stand No. 3, *Row Z, Ground Floor, Empire Hall*

This company on Stand No. 3 are exhibiting flaw-detection equipment. The Mark 5F, a multi-frequency instrument, has been specially designed for production testing and for laboratory investigations where the applications involved can be adequately met by the use of probes having twin or common transmitter/receiver transducers. This instrument is suitable for portable use: the well defined trace, extending over the full width of the 3-in. cathode ray tube can be clearly seen under normal conditions of ambient light.

The sensitivity of the instrument is such that, dependent upon the application, probe and operating conditions, defects of the order of a 3/64th inch, flat bottom hole at $\frac{1}{16}$th inch from the top surface can easily be detected.

Used in conjunction with the Kelvin Hughes Two Channel Flaw Alarm, also on show, this instrument can provide semi-automatic inspection. facilities.

Tedson, Thornley and Co.

Stand No. 17, *Outer Row, Gallery, Grand Hall*

This stand features industrial gloves of all types.

Ultrasonoscope Co. (London) Ltd.

Stand No. 4, *Outer Row, Gallery, National Hall*

A Mark III model has been added to the company's range of flow detectors. This equipment has a full 5-in. display of fine definition and high brightness to reduce operator fatigue, simplified control panel, a weight of only 28 lb., single, double or combined double probe working, accurate thickness measurement without ancillary equipment, camera adaptor for on site inspection recording.

Where the equipment is to be used for routine inspection, a contrast control may be brought into use to provide an extremely clean trace by contrasting small defect echoes against spurious echoes received from grain boundaries, the latter being reduced to a minimum value. To avoid the possible misuse of this facility a warning light is illuminated when this control is being used.

Edgar Vaughan and Co. Ltd.

Stand No. 15, *Inner Row, Gallery, Grand Hall*

Among the many products displayed on this stand are those for use in metal working; these include cutting oils, oils for deep drawing and peening, broaching oils, quenching fluids, etc., for ferrous and non-ferrous metals. Heat treatment products include liquid salts and oils, solid carburizers and various quenching media.

Rust and corrosion preventives of different types for temporary and long-term use are also exhibited.

The Walterisation Co. Ltd.

Stand No. 19, *Outer Row, Gallery, Grand Hall*

Industrial products illustrate applications of this company's wide range of metal treatment processes. These include phosphate treatments for paint-bonding, rust-proofing, cold forming and extrusion and lubrication, cold *in situ* treatments for rusty steel, aluminium and zinc surfaces, derusting and passivating solutions, a thixotropic scale-removing jelly, a decorative black oxide treatment for steel and a chemical oxide protective treatment for aluminium.

In addition, new processes developed since the last exhibition are on display. Incorporated in the stand design is an aluminium window frame illustrating the Walterbryte processes.

Thomas W. Ward Ltd.

Stand No. 11, *Row J, Ground Floor, Grand Hall*

Among the exhibits on this stand are two power presses from the Gosmeta range.

The Model EPS.100 power press is an open-fronted inclinable geared power press with adjustable stroke, having a capacity of 100 tons. Typical of the range, this machine is ruggedly built from highest grade materials, and is designed for high production work of continuous or medium batch character.

The Model EP.25 eccentric press is an important addition to the Gosmeta range. This open-fronted eccentric rigid-body power press is of 25 tons capacity, ungeared and with adjustable stroke.

The EP.25 Press is on display for the first time in this country. Thos. W. Ward Ltd. are sole agents for the United Kingdom of Gosmeta presses, which are manufactured in Amsterdam, Holland.

The company are also the sole United Kingdom distributors for Ficep shearing and bending machines, which are manufactured at Varese in Northern Italy, and on the stand a wide range of these are on show including punching, shearing and notching machines.

The Ward's display is completed by a typical unit from the comprehensive range of Oxford portable self-contained oil-cooled arc-welding transformers.

(*Continued in page* 379)

INSTITUTE OF SHEET METAL ENGINEERING • *Forthcoming Activities*

ANNUAL GENERAL MEETING AND LUNCHEON

THE Sixteenth Annual General Meeting of the Institute will be held at the Connaught Rooms, Great Queen Street, London, W.C.2, at 12 noon on Thursday, May 18, 1961. The Agenda and Notice convening this meeting has been circulated to all members.

The meeting will be followed, at 12.30 for 1 p.m., by a Luncheon at which members will have the opportunity of welcoming the new President of the Institute, Mr. E. W. Hancock, O.B.E., M.I.Mech.E., Hon.M.I.Prod.E. Mr. Hancock, who is an outstanding personality in the field of sheet metal utilization and is well-known for his forceful and progressive views on the potential for development in the sheet metal industry, will deliver his Presidential address immediately after luncheon on "Some Problems of the Motor Industry".

Members wishing to be present at this luncheon, at which visitors and guests are particularly welcome, are requested to make application for tickets as early as possible.

Tickets (price 30s. exclusive of drinks) are obtainable on application to the Hon. Secretary, Institute of Sheet Metal Engineering, John Adam House, John Adam Street, Adelphi, London, W.C.2.

MEETING ON COLD-EXTRUSION RESEARCH

In view of the obvious interest manifested in the subject of cold extrusion of steel by the large number of members who attended the recent specialist Conference in Sheffield, it was decided by the Cold Extrusion Sub-Committee of the Institute to look further into the possibility of initiating a programme of co-ordinated investigation and development of the process. To ascertain the amount of support which might be available for such a project, a questionnaire was circulated earlier this year to all those who attended the Conference and to certain other interested parties. The replies to this Questionnaire were considered at a recent meeting of the Sub-Committee when it was agreed that they provided ample justification for pursuing the project as planned. Also before the Committee at this meeting were proposals submitted for comment by the Committee for Applied Research of O.E.E.C., outlining a programme of international co-operative research and investigation into cold forming.

In order to provide an opportunity for all those interested to discuss both the proposed British programme and the projected International programme, a meeting is to be held at the Institute's offices at John Adam House on May 26. To this meeting will be invited all those who replied to the questionnaire circulated by the Institute, and also those on a further short select list drawn up by the Sub-Committee in consultation with the Overseas Liaison Group of D.S.I.R. Anyone who is in a position to participate actively in a programme of co-operative research and investigation into various aspects of the cold extrusion or cold forging process, who has not received an invitation, but would wish to attend this meeting, should communicate with the Hon. Secretary of the I.S.M.E. Cold Extrusion Sub-Committee, Mr. D. James, c/o the Pyrene Co. Ltd., Great West Road, Brentford, Middlesex.

Engineering Exhibition

(*Continued from page* 378)

B. Elliott (Machinery) Ltd.

Stands No. 9, 10, 13, *Ground Floor, Grand Hall*

At the exhibition this company are showing on adjacent stands representative models from their complete range of machine tools and engineering equipment.

All models are being demonstrated under power and particular attention is drawn to the display of "Victoria" hydraulic copy milling machines and "Cardiff" hydraulic copying lathes.

The company are exhibiting for the first time their new range of multi-spindle drilling machines, which are claimed to have considerable advantages over their previous "Progress" models.

It is now possible to position the heads to suit any particular requirement and this advance in design now enables the manufacturers to offer a total of six drilling heads on the same size table which previously only accepted a total of four heads. Similarly additional heads can now be offered on tables which formerly only accepted a total of two and three heads respectively.

One of the most interesting features of this new model lies in the design of the clean line cut-away legs. Also incorporated in the leg design is provision for a foot rest. Combinations of the following drilling heads are available :—

Model	C. No. 16	No. 1	No. 2G
Drilling capacity	½ in.	½ in.	⅞ in.
Spindle travel	3½ in.	4 in.	4 in.
Diameter of column	2½ in.	2¾ in.	2¾ in.
Max. distance chuck to table	16 in.	15½ in.	21¼ in.
Max. distance column to centre of spindle	8 in.	8¾ in.	8¾ in.
Power of motor	½ h.p.	½ h.p.	¾ h.p.
No. of spindle speeds	4	5	10
Range of spindle speeds t.p.m.	460–2,900 r.p.m.	340–2,580 r.p.m.	45–2,460 r.p.m.

Working surfaces of tables offered—31¾ × 19¾ in.
49¾ × 19¾ in.
67¾ × 19¾ in.

Résumés des Principaux Articles

Society, donne des renseignements d'un ordre général sur l'exécution du procédé, présente des résultats types obtenus par son usage et examine ses possibilités pour l'avenir, c'est-à-dire la faculté de faire usage d'une grande variété d'atmosphères au cours du procédé de la recuite. L'auteur examine ces possibilités et propose plusieurs types différents de traitements réalisables.

L'anisotropie pour favoriser une bonne ductilité page 349

Par R. L. Whiteley, D. E. Wise et D. J. Blickwede

Au cours des années, des efforts considérables ont été faits dans le but d'établir un essai unique, ou pour trouver un seul paramètre destiné à évaluer la ductilité. La variété et la complexité des opérations de l'emboutissage profond se sont, néanmoins, opposées au succès sur cette voie. Un essai unique peut fréquemment s'accorder avec certaines opérations d'emboutissage alors qu'il ne s'accordera plus avec d'autres opérations de conception différente.

Ces circonstances ont conduit les chercheurs, tout dernièrement, à évaluer la ductilité au moyen de deux expériences distinctes — la première, destinée à mesurer la capacité d'étirage du métal, et la seconde à mesurer sa ductilité réelle. Cette étude décrit une expérience destinée à définir la relation entre ces deux caractéristiques différentes du métal et les propriétés plus fondamentales d'effort-déformation plastique susceptibles d'êtres mesurées par l'essai de traction.

Le Laminoir à Froid de Brinsworth chez Steel Peech et Tozer (Succursale de United Steel Companies Ltd.) page 359

Les services de laminage à froid dont l'installation a été achevée récemment au Laminoir de Brinsworth de Steel Peech et Tozer comprennent un laminoir à froid à 4 cages 4 cylindres en tandem, un laminoir à tremper et 2 fours à cuire en plus des accessoires habituels. Le laminoir continu à 4 cages en tandem est unique en son genre en ce sens qu'il incorpore un contrôle gabarit automatique et un contrôle de tension automatique. En outre, dans la conception de la commande électrique sur le laminoir, le matériel tournant a été réduit au minimum, la majorité des prises de courant venant de redresseurs. Les 2 fours à recuire brûlent du gaz de cokerie, dont on se sert aussi pour fournir l'azote pour l'atmosphère des fours.

Zusammenfassungen der Hauptartikel

tenen Vortrages wiedergebende Artikel gibt eine allgemeine Beschreibung der Ausführung des Verfahrens, typische Ergebnisse und einen Ausblick auf zukünftige Möglichkeiten, z.B. die Anwendung der verschiedensten Atmosphären beim Glühen. Der Verfasser diskutiert diese Möglichkeiten und macht Vorschläge für die verschiedenen anwendbaren Behandlungsarten.

Anisotropie als mittel zur förderung der ziehbarkeit Seite 349

Von R. L. Whiteley, D. E. Wise und D. J. Blickwede

Seit Jahren sind erhebliche Bemühungen im Gange, die Ziehbarkeit mit Hilfe einer einzigen Prüfung bezw. durch eine einzige Stoffkonstante zu messen. Wegen der verschiedenartigen und verwickelten Natur der Vorgänge beim Tiefziehen sind jedoch nur teilweise Erfolge erzielt worden. Eine Einzelprüfung gibt oft gute Übereinstimmung bei manchen Ziehvorgängen, während bei anders gearteten die Zuordnung überhaupt nicht stimmt.

Aus diesem Grunde wurde kürzlich der Versuch gemacht, die Ziehbarkeit aus zwei getrennten Prüfungen zu bestimmen, eine zur Messung der Streckbarkeit des Metalls und eine zur Messung seiner wahren Ziehbarkeit. Der Artikel beschreibt einen Versuch zur Definition der Beziehung zwischen diesen beiden verschiedenen Metalleigenschaften und die grundsätzlicheren plastischen Spannungs-Dehnungseigenschaften, die sich durch den Zugversuch messen lassen.

Das kalt-bandwalzwerk im Betrieb Brinsworth von Steel Peech and Tozer, einer zweigfirma der United Steel Companies Ltd. .. Seite 359

Die kürzlich fertiggestellte Kaltwalzanlage im Walzwerk Brinsworth von Steel Peech and Tozer besteht aus einem kontinuierlichen Doppelduo-Kaltwalzwerk, einem Temperwerk, zwei Glühöfen und den üblichen Hilfseinrichtungen. Die kontinuierliche Doppelduostraße ist insofern außergewöhnlich, als sie automatische Dicken- und Spannungsregelung besitzt. Außerdem sind bei der Konstruktion der elektrischen Steuereinrichtung des Walzwerks rotierende Maschinen auf ein Minimum beschränkt; die Stromversorgung geschieht hauptsächlich durch Gleichrichter. Die beiden Glühöfen werden mit Kokereigas beheizt, das auch den Stickstoff für die Ofenatmosphäre liefert.

Résumenes de los Artículos Principales

ofrece información general sobre la explotación del procedimiento, dando resultados típicos obtenidos mediante su uso y estudiando sus futuras posibilidades, como por ejemplo las de emplear una amplia gama de atmósferas diferentes durante la operación de recocido. El autor discute estas posibilidades y expone sus criterios sobre los diferentes tipos de tratamiento que pueden llevarse a cabo.

La anisotropia como ventaja para lograr una buena capacidad para el estampado página 349

Por R. L. Whiteley, D. E. Wise y D. J. Blickwede

A través de los años muchos han sido los esfuerzos que se han dedicado al perfeccionamiento de un solo ensayo o para hallar un solo parámetro material que permitiese avaluar la capacidad para el estampado. Un solo ensayo a menudo se correlaciona bien con algunas operaciones de estampado pero, en general, no consigue correlacionar en absoluto con otras operaciones de estampado que no son de un diseño parecido.

Esto ha inducido a los investigadores más recientes a tratar de avaluar la capacidad para el estampado a base de dos ensayos diferentes: uno para medir la capacidad de estiramiento del metal y el otro para medir la verdadera capacidad para el estampado del metal. En este trabajo se describe una tentativa hecha para definir la relación entre estas dos caracteristicas diferentes del metal y las propiedades más fundamentales de esfuerzo plástico y deformación que pueden medirse por medio del ensayo a la tracción.

La laminadora Brinsworth para laminar fleje en frío en la Steel Peech and Tozer (Filial de la United Steel Companies Ltd. página 359

La instalación para laminación en frío recientemente terminada en los Talleres Brinsworth de la Steel Peech & Tozer comprende un tren laminador de fleje en frío, tipo tándem, de cuatro pedestales y de cuatro rodillos de altura, un laminador de temple y dos hornos de recocido, además de los elementos auxiliares acostumbrados. El laminador continuo de 4 pedestales tipo tandem es singular en cuanto está dotado de regulador automático de espesor y regulador automático de tensión. Además, en el proyecto del equipo eléctrico de control del laminador se ha reducido a un mínimo el uso de elementos giratorios, siendo la mayoría de las fuentes de energía por rectificadores.

SHEET METAL NEWS

FEATURING EVENTS AND PERSONALITIES IN THE INDUSTRY

IRON AND STEEL INSTITUTE TO VISIT U.S.A. AND CANADA

Special Meeting Arranged for Oct.-Nov., 1961

AS previously announced, the Council of the Institute have accepted an invitation from the Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers to hold a Special Meeting in the United States of America and in Canada in **October and November, 1961.** The American Society for Metals have also invited Members and their Ladies to attend their Annual Congress and Banquet and the Metals Exposition at Detroit and to visit the Society's new Headquarters at Novelty Park, near Cleveland, Ohio.

Invitations to visit their works have been received from many companies in the iron and steel industry and from other metallurgical companies and organizations in the U.S.A. and Canada.

There will be a number of social functions during the meeting, details of which will be announced later, but cordial invitations for Members and Ladies to attend social functions as guests of the technical societies or of the companies have been received for all the main centres in the itinerary, including New York City, Niagara Falls, Cleveland, Detroit, Pittsburgh, and Warren.

An Organizing Committee has been set up in the U.S.A. under the Chairmanship of Dr. J. B. Austin, Administrative Vice President, Research and Technology, United States Steel Corporation.

All arrangements for travel and hotels in the U.S.A. and Canada are being made on behalf of the Institute by Thos. Cook & Son Ltd., London and New York.

Among the works which will be visited are those of the Republic Steel Corp., the United States Steel Corp., the National Forge Co., the Bethlehem Steel Corp., the Inland Steel Corp., the Armco Steel Corp., Atlas Steels Ltd., the Dominion Foundry and Steel Co. Ltd., the Steel Co. of Canada Ltd., and the Union Carbide Corp. A visit has also been arranged to the Carnegie Institute of Technology.

Further information can be obtained from the Secretary of the Institute at 4 Grosvenor Gardens, London, S.W.1.

Special Equipment for Metal Production Industry

LAPPER EQUIPMENTS LTD., 200 Wolverhampton Street, Dudley, Worcs., has been formed to sell special equipment for the metal-production industry to customers' requirements. The equipment is being manufactured by an associate company, Maley and Taunton Ltd. of Wednesfield. The following machines are now being manufactured :—

Strip-pickling and cleaning lines, capable of handling strips from 0.125 in. down to 0.010 in. thick.

Coil-welding lines for the welding of five or six light coils to produce one heavy coil. This line has been designed mainly to suit the firm with limited financial resources.

Coil cut-up line, for strips up to 18 in. wide, complete with automatic stacking tables.

Heavy motorized uncoilers, capable of handling coils up to 10,000 lb. in weight.

Light-duty slitting lines, which have been designed as simple and as cheaply as possible, but still capable of the utmost precision.

Various coil- and strip-handling devices, to fit around existing mill arrangements.

All the standard machines have been designed as economical as possible, without losing any overall efficiency.

CO-OPERATION BETWEEN THE IRON AND STEEL INSTITUTE, THE INSTITUTE OF METALS AND THE INSTITUTION OF METALLURGISTS

THE Councils of The Iron and Steel Institute, The Institute of Metals and The Institution of Metallurgists have recently examined the problems of closer co-operation between these three societies. After careful consideration they have concluded that amalgamation of the three societies would not be practicable within the foreseeable future. The Councils therefore decided to set up a permanent Joint Consultative Committee which will meet regularly and advise their Councils on all activities and questions of common interest.

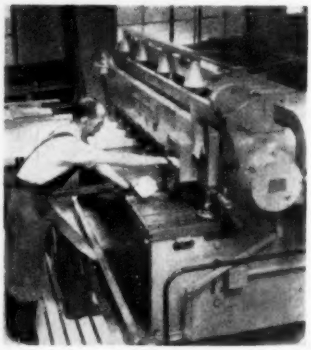
The three Councils are convinced that every qualified metallurgist should be a member both of the professional institution and of his appropriate scientific and technical institute, and should contribute to and influence the work of both. With this in view, the Council of The Institution of Metallurgists has altered the standard subscriptions payable by Members, Enrolled Graduates and Enrolled Students of the Institution resident in the United Kingdom; by agreement of the three Councils, all those in the Institution of Metallurgists who pay these revised standard subscriptions will automatically have the right to apply for membership of one of the two Institutes without liability for the payment of a further membership subscription to that Institute.

CZECHOSLOVAKIAN ORDER

THE Bronx Engineering Co. Ltd., Lye, Worcs., have recently received orders from Czechoslovakia to a total value of approximately £60,000, covering a press brake, a mill for making hoes, spades and shovels, a process levelling machine for processing sheet steel before deep drawing, and a large tube straightening machine. The orders were placed by the Czechoslovak Government Buying Agency, Strojimport, following several visits to Prague.

SCOTTISH COMPANY REDUCES SHEAR COSTS USING POWER-OPERATED BACK GAUGE

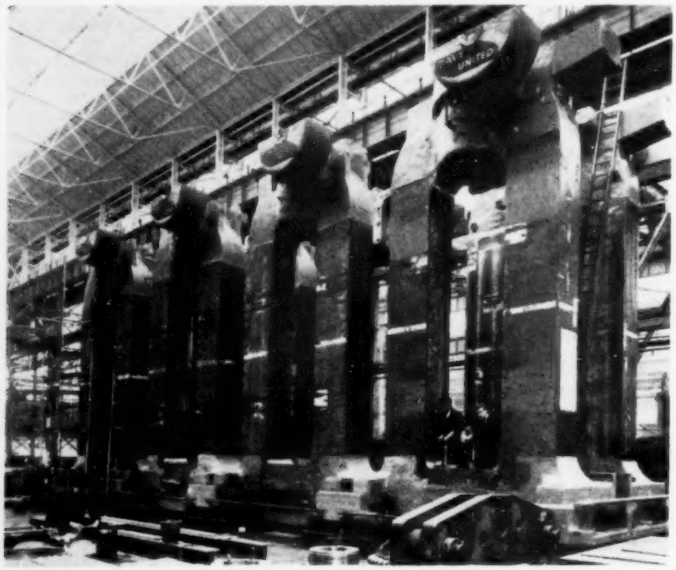
BELMOS LTD., who have three factories in Lanarkshire, Scotland, manufacture group motor control gear and other electrical equipment housed in multi-tier sheet metal cubicles, which are produced in a variety of standard widths and heights to meet customers' requirements and entail shearing operations consisting of long runs on standard parts and many short runs of continually varying size. A serious cost and time factor involved has been the operator hours in resetting the back gauges of the two guillotines employed in shearing metal for the housings and this has amounted to 75 per cent of the working time; in addition changes in cubicle design have resulted in a demand of cut sizes beyond the capacity of the guillotines. Belmos Ltd. decided, therefore, to instal a machine which incorporated a back gauge setting which was power operated and controlled from the front of the machine. The machine decided upon was one manufactured by an American company, The Cincinatti Shaper Co. of Cincinatti, Ohio, who have established a subsidiary in East Kilbride; on this machine, the operator sets the back gauge by means of push buttons from his working position. The back gauge runs on ball bearings and is actuated by alloy-steel buttress thread screws; it locks automatically to hold its setting and compensating nuts eliminate backlash; a direct-reading indicator is graduated for very precise setting. Within a few weeks of the installation of the new machine, Belmos Ltd. found that a single machine could do the work of the two machines previously employed, not only because of the time saved in resetting but also because the shorter stroke of the machine resulted in a much higher output. In terms of labour and time costs, it is estimated that the machine will pay for itself in two years.



Guillotine with power-operated back gauge

RECENT PROGRESS ON NEW COLD-STRIP MILL FOR COLVILLES

EIGHT cast-steel roll housings, each weighing 121 tons, in the heavy erecting shops of the Darnall works of Davy and United Engineering Co. Ltd. These housings are for a new 68-in. 4-high, 4-stand tandem cold-strip mill which Davy-United are building, along with a single-stand temper mill, for the Gartcosh works, near Glasgow, of Colvilles Ltd. Colvilles are establishing at Gartcosh, cold-rolling plant based on these mills to process the hot-rolled strip which will be produced in the new hot-strip mill being built by Davy-United at Ravenscraig.



BRITISH AMERICAN STEEL FINISH COMBINE

AN agreement has recently been concluded between Tool Treatments (Chemicals) Ltd. of West Bromwich and the Chemical Corporation of Massachusetts, U.S.A. whereby the successful chemical black on steel finish produced by Tool Treatments (Chemicals) Ltd. will be marketed under licence in America by the Chemical Corporation and the " Luster-on " products of the Chemical Corporation, who are claimed to be the leading company in America on chromate conversion treatments, will now be marketed in this country by Tool Treatments Ltd.

DESOUTTER BROS. FORM NEW SUBSIDIARY

DESOUTTER BROS. (HOLDINGS) LTD. have formed a new subsidiary, Carter Stevens (Automation) Ltd., to carry on the business of Carter Stevens and Co. (Engineering), Carter Stevens and Co. (Automation) and Blakeman Designs, all of Coventry. Desoutter Bros. (Holdings) will subscribe 76 per cent of the issued share capital, which in the first instance will be in the region of £50,000. Messrs. W. J. Carter, P. Stevens, G. D. Simpson, R. E. Stockley, and D. W. Blackman, are joining the board of the new company.

SPRAYING POLYURETHANE FOAM

THE Aerograph-De Vilbiss Co. Ltd., Sydenham, London, S.E.26, recently demonstrated their new "Foam-in-Place" equipment developed for spraying rigid polyurethane foam made to a special formulation by the Baxenden Chemical Co. Ltd.

Until the development of the new spraying technique there have been two methods of producing foam :

(1) Machine mixing, using special and necessarily expensive equipment for the production of foam sheets or blocks.

(2) Batch mixing in buckets (using hand or electric stirring).

In either case it is necessary to use some form of shuttering or battening to retain the foam in position.

In some instances the older methods will continue to remain the most economic method of foam production, but a large number of applications particularly lend themselves to this new simplified spray system.

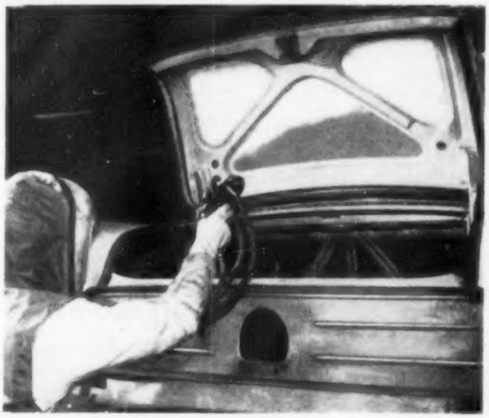
Some of these applications were shown during the demonstration which included a quick-fire spray insulation of a large section of steel plate, a roof interior, a complex but typical arrangement of service pipes, a ventilation duct and storage tank.

Metal and plastic panels used in cars, boats and planes were also sprayed to show the anti-drumming and good strength qualities possessed by this foam as well as its outstanding property as an insulant.

Another interesting application was illustrated by the internal lining of a packing case for the dual purpose of preventing the entry of moisture and also to absorb shock and so avoid damage to the contents.

The gun used has two spraying heads built into one casing, the two fluids used to produce the foam being mixed outside the gun, *i.e.* immediately on emerging from the nozzles. Other than the gun the remainder of the equipment, viz., two pressure feed tanks, is standard with stainless-steel fluid passages and fittings. Also required is an air transformer. The spraying equipment is simple but special protective helmets must be worn by the operatives. The sprayed foam has very high insulating properties, good strength, light weight, and is impervious to attack by a wide range of corrosive environments.

(Above).—The spray gun



(Right).—Spraying a motor-car boot lid

BRITISH FIRM ACQUIRE CONTROLLING INTERESTS IN SWEDISH PRECIOUS METAL COMPANY

JOHNSON, MATTHEY AND CO. LTD. have acquired a controlling interest in the Swedish precious metal company A/B Gösta Nyström of Stockholm. Mr. Gösta Nyström, who founded the business in 1917, has retired and a new board has been appointed consisting of four Swedish and two British directors, with Mr. Ove Trulsson as chairman. A/B Gösta Nyström supply precious metal products fcr all industrial purposes as well as for jewellery, silversmithing and dental requirements and since 1932 have acted as agents in Sweden for some of the products of Johnson Matthey. The company will be known in future as A/B Nyström and Matthey.

AWARD TO DISTINGUISHED AMERICAN ENGINEER

THE Council of The Institution of Mechanical Engineers have awarded the 1961 James Watt International Medal to Professor Dr. Theodore von Karman, Ph.D., in recognition of his contributions to the advancement of mechanical engineering science, which have extended the frontiers of engineering knowledge particularly in the field of aeronautics. The nomination of Professor von Karman for this award was sponsored by the American Society of Mechanical Engineers. It is hoped that the presentation of the medal will take place at a meeting of the Institution later in the year. The James Watt International Medal was founded to commemorate the bi-centenary of the birth of James Watt, which took place on January 19, 1736.

CHANGE OF NAME FOR MOND

THE Mond Nickel Co. Ltd., an affiliate of The International Nickel Co. of Canada, Ltd., recently changed itf name to The International Nickel Companys (Mond) Limited.

Making this announcement, the chairman, Mr. Ivon A. Bailey, said that it did not involve any change in the company's organization or in its business activities. The board, in consultation with The International Nickel Co. of Canada, Ltd., the parent company took the view that the change of name would, in addition to indicating the international nature of the company's activities, serve to identify it more closely with the Canadian company and the United States affiliate, The International Nickel Co. Inc.

TRIPLE-ACTION PRESS INCREASES PRODUCTION

KNOWN for over 60 years as manufacturers of pressings to the cycle and motor cycle industry, the Speedwell Gear Case Co. Ltd., of Witton, Birmingham, in 1930 entered the more specialized fields of metal working for the radio, electrical and ventilating industries. The company therefore decided that hydraulic press equipment would, for many applications, be more satisfactory than mechanical presses, owing to the shorter runs and greater diversity of output.

Testing and development of this means of production began when the Speedwell company embarked on an expansion programme which included consideration of the use of suitable hydraulic press equipment, and as a result of this research, Foster, Yates and Thom were approached in 1954 and developed, to special order, a "Lancastrian" 300-ton double action drawing press.

This press was so successful that Speedwell decided to place a further order worth over £20,000 for a large 300-ton triple-action press, which is now in operation. This gives much greater flexibility of approach than the mechanical single acting press working against a cushion. The press will, however, take single acting tools by using the sub-ram as a cushion. For this reason the machine makes a useful bridge between single and double acting tools.

Features of the press are the fingertip control of the tonnage pressure of the main ram and die-cushion, and the fact that the blank-holding pressure is adjustable individually on all four rams. In addition the die-cushion pressure can be automatically adjusted during the pressure stroke. The press is automatic per cycle, and the pressure stroke halts and reverses automatically on either position or pressure. The bed area is 84 × 54 in., and the shut height 3 ft. 8 in.

NEW FILM BY THE GAS COUNCIL

A NEW colour film produced by The Gas Council, entitled "The Heat of the Matter," shows in very understandable forms the important part played by gas in various industries. Included in this film is an interesting sequence on the use of gas for the continuous annealing of tinplate.

ELECTRICAL EQUIPMENT FOR ROLLING MILLS

AN agreement has been concluded between Bruce Peebles and Co. Ltd., of Edinburgh, and REGA Brucker and Co., of Sieburg, Germany, for the joint production and marketing in the United Kingdom and Eire of complete electrical equipments for the operation and control of ferrous and non-ferrous hot and cold rolling mills. This agreement unites in this field the resources of these two well-known organizations.

FULL HOUSE FOR HEVAC

THE First International Heating, Ventilating and Air Conditioning Exhibition at Olympia, London, from September 26 until October 6, 1961, will be the greatest ever display in Europe from this rapidly expanding industry.

Covering an area of more than one hundred thousand square feet, 220 firms, many of them from overseas, will show all aspects of heating, ventilating and air conditioning including industrial air handling and treatment equipment; dust and fume collection; mechanical draught; process heating; cooling; allied and ancillary equipment and services.

During the Exhibition, from September 27 until October 4 at Olympia, there will be an International Conference on Heating, Ventilating and Air Conditioning. Organized by the sponsoring body, The Institution of Heating and Ventilating Engineers, in co-operation with The Association of Heating, Ventilating and Domestic Engineering Employers and The Heating and Ventilating Research Association. The conference will cover three main themes: (1) Administrative Advances likely in the next ten years. (2) Technical Advances likely in the next ten years. (3) Integrated Design of Architectural and Engineering Services for Economy of Building Construction.

PRESSED STEEL'S EXTENSIONS

THE illustration below shows the most recent extension to the Pressed Steel Company Ltd.'s Works at Stratton St. Margaret, near Swindon, which is now nearing completion. This is one of the largest single roofing operations undertaken in this country and was carried out by D. Anderson and Son Ltd., of Manchester, using 300 tons of alloy supplied by The British Aluminium Co. Ltd.

At the Pressed Steel's Cowley factory, where the trim manufacturing facilities were wrecked by fire two years ago, a new four-storey trim manufacturing plant—possibly the most modern of its kind in Europe—has gone into operation. The new building, totalling 99,000 sq. ft. of production floor, houses the upholstery manufacturing equipment, and stores reserves of window glass, radiator grilles, etc.

OBITUARY

Kirchner: It is with deep regret that we announce the recent sudden death, at the age of 52, of Richard Kirchner, M.I.Mech.E., M.I.Prod. E., while holidaying on his yacht at Fareham Creek, Hants. Mr. Kirchner was deputy chairman and joint managing director of Arnott and Harrison Ltd., Willesden, and a director of Crawford Collets Ltd. and Omes Ltd.

Mr. Kirchner was a member of council of the Institute of Sheet Metal Engineering from 1948 until the time of his death, and was chairman of the Institute for the sessions, 1956-58. His support for the Institute, from its earlier days, was enthusiastic and unfailing.

He was also a vice-president of the Gauge and Tool Makers' Association and, as a founder member and signatory of the original Memorandum and Articles in August, 1942, had always taken an intensely keen and active interest in all the affairs of the G.T.M.A. From the inception of the Association, Mr. Kirchner had been a member of council, and in the 18½ years of the Association's existence, he only missed two of the regular monthly council meetings, a truly remarkable record.

Mr. Kirchner was honorary treasurer of the G.T.M.A. from March, 1947, to December, 1956; and a vice-chairman from December, 1956, until December of last year when he

Richard Kirchner

was promoted to the position of a vice-president.

He joined the Institution of Production Engineers in 1933, and was a founder member of the Institution's technical and publications committee; he was a member of council for many years and was chairman of the London Section of the Institution for the session 1951-53. In 1938 he was awarded the Institution medal for the best paper by a member. His enthusiasm for the work of the Institution will be remembered, in particular, by the London Section with which he was closely connected.

His passing will be a very great loss to his group of companies and to his many friends in industry.

Mr. Kirchner leaves a widow and three children.

IRON AND STEEL INSTITUTE AWARDS

THE Council of The Iron and Steel Institute has announced the award of the following medals and prizes:

Bessemer Gold Medal for 1961

To Mr. William Barr, O.B.E., Director and Chief Metallurgist, Colvilles Ltd. Mr. Barr has been a Member of the Institute since 1925. He was elected a member of Council in 1948, Honorary Treasurer from 1953 to 1959, and President from 1959 to 1960.

Sir Robert Hadfield Medal for 1961

To Mr. Emrys Davies, managing director, Brymbo Steel Works.

Williams Prizes for 1960 (*£50 each*)

To Mr. T. McHugh and Mr. F. A. Kirk (Low Moor Fine Steels Ltd.) for the paper "Some aspect of steel extrusion".

To Mr. J. Chapman (Steel, Peech and Tozer) and Mr. W. Montgomery (Round Oak Steel Works Ltd.) for the paper "The effect of flow distribution on air preheat in the open-hearth furnace".

METAL AND PLASTIC COATINGS SYMPOSIUM

THE Metal and Plastic Coatings Association will hold a Symposium on May 9, at 2.30 p.m. in the conference room at the Earls Court Exhibition in conjunction with the First International Industrial Finishes Convention and Exhibition.

The following papers will be read:

"The Characteristics of Raw Materials in Plastic Coatings", by J. A. Rhys, M.Sc.A.K.C., F. W. Berk and Co. Ltd., National College of Rubber Technology.

"Metal Spraying for Finishing Preparatory Treatments", by J. F. Stanners, B.Sc., Chemical Department, British Iron and Steel Research Association.

"Painting Sprayed Metal Coatings", by Dr. L. Valentine, B.Sc., Ph.D., Paint Research Station.

Further information is available from The Secretary, Metal and Plastic Coatings Association, 189 Brent Crescent, North Circular Road, London, N.W.10.

NEW COMPANY TO MARKET WELDING AND BRAZING MATERIALS

A COMPREHENSIVE range of low heat input metal joining alloys are being marketed by a new company, Welding Improvements Ltd., Northampton, under the trade name of "Fontargen".

The alloys which are already used in Europe, will be sold in the U.K. and Ireland through technically trained representatives, and through a number of regional stockists to be announced later. Expert technical service will be rendered direct to users by the company's own welding engineers. Extensive facilities for metal joining demonstrations and for handling customers' special problems are available.

Mr. Eric Hindson and Dr. H. E. Zentler Gordon have been appointed directors of Welding Improvements Ltd. Dr. G. M. Blanc of Zurich, well known in international welding circles will act in a consultative capacity. Dr. Zentler Gordon was formerly U.K. representative of Battelle Memorial Institute and is well known in this country through his earlier association with the electrolytic polishing of metals. Mr. Hindson, a welding engineer and metallurgist, was associated with Fusarc Ltd., Quasi Arc Ltd., and Oerlikon Electrodes (Great Britain) Ltd. The range of alloys available comprises more than 60 types of coated arc-welding electrodes; also rods, and fluxes for use with oxyacetylene, gas-air, induction, resistance, furnace and similar heating methods. The range is divided into groups for application to steels, cast iron, stainless steels; copper, brass, bronze, light alloys, nickel and nickel alloys; other types include a full selection of silver brazing alloys, special soft solders, surfacing alloys for heat-, wear-, and corrosion-resistance, and electrodes for cutting and gouging all metals.

Full details may be obtained from Welding Improvements Ltd., P.O. Box 32, Northampton.

NEW AGENCY FOR ITALIAN MACHINE

ELGAR MACHINE TOOL CO. LTD. are now exclusive distributors in the U.K. for the Model 2000 horizontal precision boring machine, manufactured by Fabbrica Macchine Industriali of Naples. The machine is arranged with a table 24 in. × 18 in., the spindle diameter being 80 mm. and having spindle speeds of 35 to 1,750 r.p.m

APPOINTMENTS and STAFF CHANGES

Wickman Ltd. announce that Mr. H. B. Morris has been appointed to the board.

Mr. Morris joined the company in 1938 and served with the R.A.F. from 1939 until 1944. In 1948 he was transferred to the Wickman subsidiary Arc Manufacturing Co. as chief accountant and was later appointed secretary to that company, and in 1955 was appointed secretary to the parent company.

* * *

Mr. H. Martin, home sales manager of **Murex Welding Processes Ltd.,** Waltham Cross, Herts., has retired after 38 years' service in the company. Mr. R. E. H. Bell, assistant home sales manager for the past ten years, has been appointed home sales manager.

Mr. K. Leevers, A.M.I.E.E., A.M.I.Mech.E., and Mr. P. Hobbs, B.A. (Cantab.), have been appointed assistant home sales managers (Technical), and Mr. S. E. Smith plant sales manager.

* * *

Martonair Ltd., manufacturers of pneumatic equipment, have appointed Mr. M. R. Taylor as technical representative for East Staffordshire, Derby, Sutton Coldfield and northern Birmingham.

* * *

Shell-Mex and B.P. Ltd. announce that Mr. George Richardson has been appointed manager, Industrial Fuels department.

This is a new department formed from the present Fuel Oil department and the company's subsidiary, Shell-Mex and B.P. Gases Ltd. This merging of the fuel oil and liquified petroleum gas interests brings together the sale of these products to industry and commerce generally. It is primarily designed to facilitate co-ordination of technical sales developments and ensures for the customer a comprehensive advisory service on the choice of the right fuel for the job.

* * *

The appointment is announced of Mr. Ronald G. Hooker, J.P., as deputy managing director of **K. and L. Steelfounders and Engineers Ltd.,** Letchworth. The company is an important member of the George Cohen 600 Group and operates one of the country's largest and best-equipped steel foundries as well as manufacturing the Jones range of mobile cranes.

Mr. B. A. Thurgood, after 31 years' service with George Cohen Sons and Co. Ltd., has been appointed resident director of **George Cohen Australian Scrap Company Proprietary Ltd.,** Sydney, the company whose formation was announced by the George Cohen 600 Group towards the end of last year. Mr. Thurgood, who until recently was George Cohen's branch manager in Morriston, nr. Swansea, South Wales, has already left to take up his new post in Australia.

* * *

Mr. T. K. Singer has been appointed general sales manager of **James Booth Aluminium Ltd.**

Mr. Singer was formerly an executive with Kaiser Aluminum and Chemical Corporation and has represented that company both in the U.S.A. and in this country. The appointment is made following the resignation of Mr. D. McL. Burnell. Mr. Frank J. Mills continues as sales manager.

* * *

Mr. R. Lewis Stubbs, director of the Zinc Development Association, has been appointed director-general of the **Lead Development Association** and of the Zinc Development Association. He will be responsible for the overall direction and expansion of the work of both Associations, and will represent them at international meetings. Each Association will continue to function separately, and general managers for both are to be appointed.

* * *

Mr. D. K. Fraser, joint managing director of **G. A. Harvey and Co. (London) Ltd.,** has been appointed managing director. Mr. H. E. Cooper has relinquished his office of joint managing director but remains a director of the company.

* * *

Mr. A. G. Cleghorn, A.M.I.-Mech.E., general manager, Blackheath Works, Birmingham and Mr. W. H. Wentworth Ping, general sales manager, have been appointed special directors of **Firth-Vickers Stainless Steels Ltd.**

Mr. HARRY RICHARDS

Mr. Harry Richards, chairman of **Wolf Electric Tools Ltd.,** London, W.5, has retired after 53 years' distinguished service.

After joining the company in 1907 as service manager, Mr. Richards subsequently filled various executive positions, and was appointed to the board in 1926. In 1932 he became works director of the first Wolf factory, managing director in 1933, and chairman in 1951.

Mr. Richards retains his seat on the board of Wolf Electric Tools (Holdings) Ltd.

* * *

Kestner Evaporator and Engineering Co. Ltd announce that, coincident with the retirement of Mr. J. Arthur Reavell, M.I.-Mech.E, M.I.Chem.E., F.Inst.F., F.I.M., from the chairmanship of the Group and his appointment as president, the following changes have been made in the board: Mr. B. N. Reavell, B.Sc., A.C.G.I., M.I.Mech.E., M.I.-Chem.E., M.Inst.F., has been appointed chairman, Mr. G. H. Black, managing director; and Mr. C. A. Pither, F.C.A., director and secretary, on the retirement of Mr. W. S. Knight, after 47 years as director and secretary. Mr. J. W. Grose, B.Sc., A.C.G.I., A.M.I.Chem.E., continues as an executive director.

* * *

Sir Walter Benton Jones, Bt., has retired from the board of **Davy-Ashmore Ltd.** and Mr. M. F. Dowding has been appointed a director. Mr. Dowding is general manager of the Machinery Division of Davy and United Engineering Co. Ltd., one of the Davy-Ashmore subsidiaries.

As agreed in principle at the time of the Davy-Ashmore merger, Mr. C. E. Wrangham, formerly chairman of Ashmore, Benson, Pease and Co. Ltd. and of P.G. Engineering Ltd., has resigned from the boards of these subsidiaries and Mr. M. A. Fiennes has been appointed chairman. Mr. Fiennes is managing director of Davy-Ashmore Ltd.

"This is why 'FASTEX 5' is Britain's top selling welding electrode . . ."

MUREX

More Murex "Fastex 5" welding electrodes are sold in Great Britain than any other type and this is why—(1) The quality of "Fastex 5" is high and consistent. (2) It is an extremely efficient electrode—fast in operation, smooth running, capable of producing high quality welds with an absence of undercut. (3) "Fastex 5" is simple to use and slag removal is easy. (4) Although primarily designed for downhand welding, the electrode can be used in other positions. (5) It is suitable for a wide range of fabrication work and can be used on a variety of mild steels. (6) It is backed by the most modern manufacturing and research facilities and a first class sales and service organisation—And its price is competitive! No wonder "Fastex 5" is Britain's top selling electrode.

MUREX WELDING PROCESSES LTD., WALTHAM CROSS, HERTS.

T.43/607

NEW PLANT and EQUIPMENT

A monthly review of new machines, equipment, processes, etc., of interest to the producer and user of sheet metal

Hydraulic Transfer Drawing, Piercing and Trimming Presses with Manual Transfer

IT has long been found in the press working of metals that there is a wide range of components which require a series of press operations which on first consideration suggest the use of a transfer press. On further investigation, however, it is found that, first, because of the number of stages involved and, second, because of either the required rate of production or the limited period over which the product is to be manufactured, it would in fact be uneconomical to invest in a transfer press. Such components are therefore frequently considered for producing on a series of tools set up side by side on an ordinary wide frame power press, to be transferred manually between stages. This brings immediate advantages in handling time as compared with operations on completely separate machines, and it also reduces floor space requirements, etc. Difficulties, however, arise because at least where more than one component is to be produced in this way, *i.e.* where this method is mainly applicable, it is difficult to find the right machine for the job, as different components require different lengths of stroke, speed, etc. Furthermore, to set up tools side by side in this way is a tricky operation, and a mechanical press can be very easily overloaded during setting if great care is not exercised.

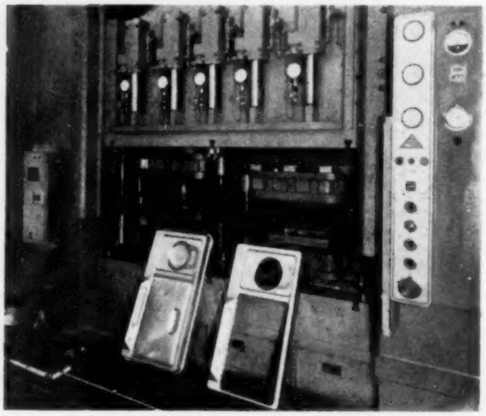
All these difficulties are largely overcome if a hydraulic press could be used, but in the past these were not considered suitable for blanking or piercing and they were designed purely for balanced loading, *i.e.* with the centre of load acting along the centre-line of machine.

SMG of Wiesental near Karlsruhe, represented by Pearson Panke Ltd., have, however, evolved a hydraulic system (which is incorporated on all their hydraulic presses) which is so constructed that the machines can be used for trimming and piercing, as well as drawing. These presses have already proved invaluable for this type of work, especially where, for example, piercing is required in the bottom of a deep-drawn component, as for this a very long-stroke mechanical press would be needed which would be slow in operation, whereas on a hydraulic press the fast-approach can be utilized up to very close to bottom of stroke. From the point of view of capital outlay, hydraulic presses compare more and more favourably with mechanical presses as the required length of stroke increases.

(*Continued in page* 390)

Fig. 1 (*left*)—*Hydraulic press*

Fig. 2 (*below*)—*Typical tooling on hydraulic press*



In addition, on the machine which forms the subject of this article (*see* Fig. 1) a special ram is fitted with ram guides going up to the very top of the headpiece, and with this arrangement, in conjunction with the hydraulic system employed, the press is capable of withstanding considerable out-of-balance loading. This of course is an essential feature where tools are to be arranged side by side for carrying out succeeding operations which may require varying pressures.

As on all SMG hydraulic presses, the machine which is shown in Fig. 1 is fitted with an axial piston pump so that not only the pressure and stoke, but also the speed is infinitely variable in such a way that best use can always be made of the available horse-power if desired.

The machine is designed to be adaptable for a wide variety of work and for setting up varying numbers of tools, the main limitation in this respect—other than dimensions and pressure—being the number in drawing cushions, in this case two. Five hydraulic tool-actuating mechanisms are built into the ram, each capable of exerting 7.5 tons pressure, and each with independent, accurate pressure control. Openings are provided in the press uprights, 800 mm. wide × 1,250 mm. high.

The capacity of the typical machine illustrated is as follows:—

Maximum pressure	400 tons
Size of table and ram face, l. to r. × f. to b.	2,200 × 1,500 mm.
Maximum distance between table and ram	1,250 mm.
Maximum stroke of ram	900 mm.
Power required	100 h.p.

The two hydraulic drawing cushions are each capable of exerting 80-tons pressure for 350-mm. depth of draw, with a pressure plate of 1,000 × 1,100 mm.

A close-up of a particular tool set is shown in Fig. 2. The machine shown is set up for making the top panel of a washing machine. In the first tool the somewhat elaborate shape is drawn and formed, and in the second tool the two large openings are pierced and the flange is trimmed off. It will perhaps be appreciated that with components of this sort of size, the fact that it is not necessary to take the component to a second machine for the second operation will result in very considerable saving, both in handling and of course potential damage to the component.

The photograph also shows the pressure gauges for the five cylinders in the ram; on the main control panel the pressure gauges for the ram and the two cushions, and alongside it, the remote control thermometer with automatic switch for heating and cooling, and the built-in stroke counter. As on all SMG presses the main control panel itself is kept extremely simple to avoid confusing the operator.

The machine is fitted with an E.S. Photo-electric guard, of which about 50 have been installed in the U.K. in recent years, mostly on SMG hydraulic drawing presses.

Cold-forging Press

A MECHANICAL press for cold forging steel which has been specially designed and constructed in the U.K. by Cold Forging Ltd. of 29 Hanworth Road, Sunbury-on-Thames, Middlesex, (a member of the Camp Bird Group), is shown in Fig. 3. This press is capable of producing a working pressure of 200 tons 30 deg. before b.d.c., and the main feature of its design is that it will forge a large variety of cold-forged parts of different shape, size and weight.

The press was specially designed for the use of multiple tool units, which allow up to six forging operations to be carried out per stroke of the press; the design of these tools as a compact unit allows a quick change to another group of operations by changing the complete tool-unit

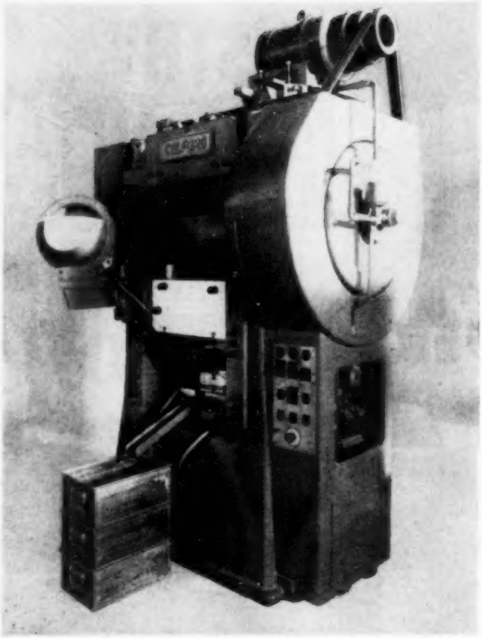


Fig. 3.—Cold-forging press

which can be pre-set already in the tool-room. The design permits the eccentric loading of the press without causing uneven lateral pressure on the tools. The press is powered by a 20-h.p. motor which drives the fly-wheel *via* a 3-speed "V" belt drive to provide stroke rates of 60, 75, and 90 per minute and the crank is engaged through a clutch of the pneumatic-setting, spring release type; these controls are electrically interconnected for safety reasons in event of pneumatic failure. The reduction of speed between fly-wheel and crankshaft is obtained by a special epicyclic gear and the capacities of the flywheel and motor are such that a high amount of work per stroke is available for extrusion operations. The pneumatic system itself is of the fail-safe type and incorporates electrical apparatus which prevents any of the controls from being actuated in the event of a defect. Owing to the versatility of the press, it has been necessary to adopt an extremely flexible safety system; the safety devices are of the closed-circuit type and usually take the form of microswitches; these are actuated by the various safety trips which come into operation in the event of tool fracture, feed defects, ejector blockage, etc., and the pneumatic system is instantly tripped and the machine stopped within 10 deg. of its cycle of rotation. In the event of a tool jamming at the bottom of the stroke, facilities are provided whereby the press can be operated very slowly by hand in order to release the tool; this takes the form of a small gear wheel which can be engaged on to the toothed wheel attached to the fly-wheel. The ejector is operated by a cam on the main crankshaft which can be easily changed to facilitate a variable control of the ejector stroke and time cycle. The main motor of the machine, which is electrically coupled to the oil pump motor, is started by an automatic star delta switch controlled from the main cabinet to the right of the machine, which also includes

(Continued in page 392)

Canteen Catering

As in every other industry, the main factors governing the economics of the catering business are: quality of product, cost of production, and well-being of workpeople. Electricity measures up well to these three essential factors.

The outstanding virtue of electricity is better cooking, particularly in roasting and pastry ovens where high quality is more easily maintained than in ovens using other forms of heat.

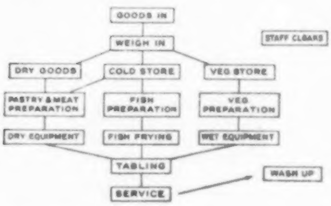
The cost of production varies somewhat with the type of food and the size of the establishment, but is usually between ½ and ¾ of a unit of electricity per meal. Cleanliness of electric cooking is axiomatic and provides better working conditions for the staff.

The actual size of the kitchen is influenced greatly by its shape and by the number of people catered for, but a rough guide is as follows:

Kitchen to deal with up to:	*Size:*
100 persons	5-6 sq. ft. per person
100-250 persons	4-5 sq. ft. per person
250-1000 persons	3-4 sq. ft. per person
over: 1000 persons	3 sq. ft. per person

Design

Where the kitchen is designed from the start for the full use of electricity, planning is simplified as the equipment can be placed where it is required without reference to the need for flues.

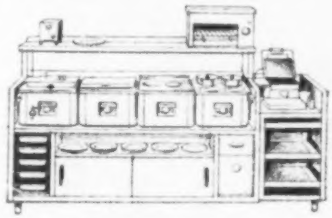


If an existing kitchen is already using other types of cooking equipment, however, electrical equipment can still be introduced item by item to bring increasing benefits.

Quick-service Equipment

The popularity of the quick-service establishment where the food is cooked at the service counter in the full view of the customer is steadily growing, and this type of catering can readily be provided in the canteen by the installation of a Back Bar cooking unit, installed behind a section of the service counter.

The popularity of the mid-day joint and two vegetables is on the wane and the really up-to-date canteen should provide the welcome alternative of fresh food cooked on the spot.



Electric Catering Equipment

Electric catering equipment covers every single kitchen activity and some of the appliances in common use are:

COOKING. Ranges, boiling tables, steaming, roasting and pastry ovens, vegetable boilers, fryers, griller/toasters.

SERVICE AND WASHING-UP EQUIPMENT. Bains-marie, hot cupboards, washing-up machines for the larger kitchen and sterilising sinks for the smaller, refrigerated cold-service counter and display cabinets, soda fountains.

PREPARATION. Mixing machines with attachments for chopping and mincing, etc., potato peeler, slicing machine.

QUICK-SERVICE EQUIPMENT. Infra-red (contact) grill, automatic toaster, griddle plate, automatic fryer, boiling plates, soup heaters, etc., and, of course, the indispensable refrigerator.

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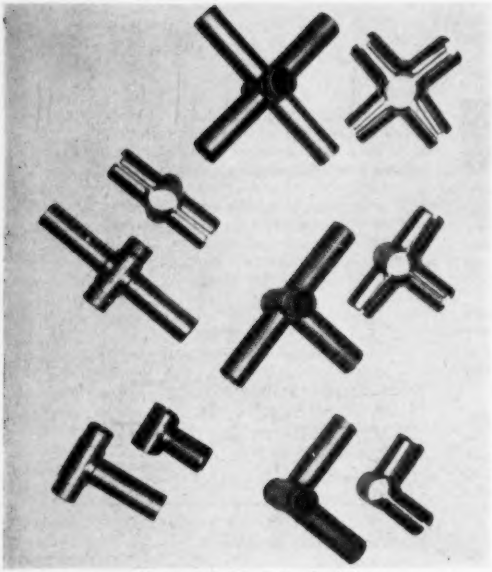


Fig. 4.—" Clinch " tube joints

controls for selecting automatic and manual operation, while the operating panel on the right-hand front side of the machine contains the push buttons for selecting single-stroking, inching, normal operation and stop.

Tube Joints

"CLINCH" tube joints (Fig. 4), produced as sheet metal pressings are available from Access Equipment Ltd., Maylands Avenue, Hemel Hempstead, Herts. They make the assembly of tubular structures of all types a simple operation and the joints have been tested and shown to be stronger than the mating tubes.

The joint operates on the principle of internal pressure of one tube balancing the external pressure of the other. The single Tee joint, for example, is slid over the first tube; the sprung spigot stems are then compressed with a self-locking wrench or spanner and inserted into the right-angle tube. The joint is then consolidated with a hammer or mallet.

Most forms of storage racking can be constructed using only the two basic joints, S.T. 125 Single Tee and S.C. 125 Single-Cross joints. All are available in semi-bright finish, lightly oiled or electro-galvanized.

By using these two joints, rigid, high load bearing racking schemes can be carried out in a remarkably short time as against structures assembled with nuts, bolts and screws, etc.

The joints are readily available for 1½ in. o/d × 16 s.w.g. resistance-welded tube obtainable from tube wholesalers or direct from Access Equipment. Joints for 1 in. o/d × 16 s.w.g. tube are now available and other sizes will follow.

Accessories such as adjustable floor pads, castors, and various types of feet are also available. The range of joints also includes double-Tee (DT), double-cross (DC) and Tee-cross (TC).

Electronically Controlled Foil Press

A HORIZONTAL foil press, designed and manufactured by H. and T. Mellor Ltd. of Chapel-en-le Frith, for the production of aluminium foil cups and trays, incorporates photo-electronic controls specially designed and made for use with the press by Hird-Brown Ltd, of 244 Marsland Road, Sale, Cheshire.

The Mellor press, which will accept aluminium foil rolls of up to 16 in. wide with an adjustable through feed of up to 10 in., will operate at 50, 75 or 100 strokes per minute. Alternatively, a variable-speed drive can be fitted. The press is 6 ft. long by 5 ft. 6 in. high by 3 ft. 9 in. wide and weighs 35 cwt.

The die-plate has been so designed that several aluminium foil cups can be pressed at one time; these fall into a space below the machine where they can be either stacked or carried away on a conveyor. The electrical equipment supplied by Hird-Brown Ltd., ensures that should the foil break or bend the machine will stop immediately and a blue light will signal to the operator. Another safety device is a micro-switch, located behind the fixed die plate, which will stop the press if a foil cup fails to eject from the die set. The press is intended for semi-automatic operation so that after a new foil has been fed into the machine the operator can start it up and leave it until a pre-set number of strokes have been made.

The heart of the electrical installation is a control cubicle 12 in. by 18 in. by 6 in. together with a 15-amp isolator for incoming mains. The whole circuit is a "fail to safe" one and is supplied ready for connexion to the customer's supply. The main operating station, which is a case measuring 9 in. by 6 in. by 4 in., contains three control push-buttons—start, stop and reset—and the meter for lining up the photo-cell and light source.

A Lettering Instrument for Draughtsmen

LETTERING on drawings and for various kinds of display work will be simplified and speeded up by the development of a new lettering instrument. Instead of conventional stencils, the instrument uses a pantograph principle; the master letters on an engraved metal template are traced out with a stylus, and this controls the movement of the pen through a mechanism which allows the size of lettering to be greater or less than that of the template.

The degree of enlargement or reduction is set independently for the vertical and horizontal directions; as a result, tall thin letters or elongated squat letters can be produced from the same template. The mechanism is precision made, and controls are provided by which the height and width of the letters produced from the standard template can be adjusted and read off directly in thousandths of an inch.

Templates carrying alphabets in different styles of lettering are immediately interchangeable.

The instrument was developed in the U.S.A. and is available from the Varigraph Division of General Trade Equipment Ltd., 82-90 Seymour Place, London, W.1.

Colour Mixing Device

THE industrial division of Blundell, Spence and Co. Ltd., have produced a colour mixing device, the Vulmeter, which needs no dipstick, but uses the relation between the angle of tilt and volumetric content to indicate the amount of each ingredient colour, when mixing paints to prescribed formula. The device consists of a tilting platform, secured by a wing nut, and a quadrant scale which indicates at various degrees of tilt the amount of unthinned paint required to produce ½ pint, 1 pint, or ½ gallon in tins of twice those capacities. The method of mixing is to place the tin on to the platform which is tilted until the pointer indicates on the appropriate scale the amount of the first basic colour read from the mixing formula; a spring clip is then fixed to the tin on the lower side and the paint poured in until it just touches the tip of the clip; the platform is adjusted and the performance repeated for each basic colour. The paint is then thoroughly stirred and thinners added when the tin is upright to bring the level of the paint up to a

(*Continued in page* 394)

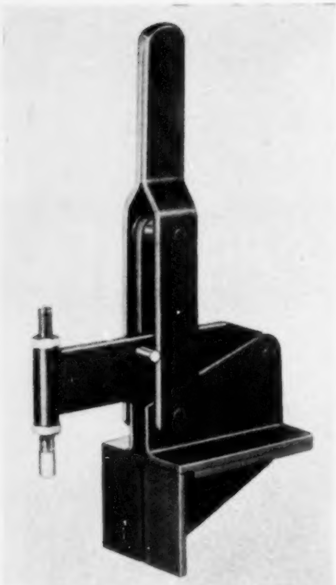


Fig. 5 (left).—Front-mounting clamp

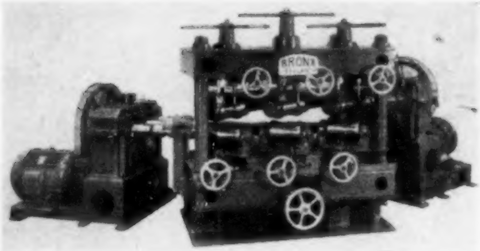


Fig. 6.—Tube-straightening machine

special mark on the spring clip. The device is for users of Blundell, Spence and Co.'s two main transport finishes, Vulflo Self Gloss and One Coat Glossex.

Front-mounting Clamps

A NEW range of front-mounting clamps has been introduced by Speed Tools Ltd., Vereker House, Gresse Street, London, W.1. Nine models are available, of which six are vertical types and three are flat or horizontal designs.

Fig. 5 shows one of the vertical clamps Model ST 250FM, which will be recognized as a standard "Speetog" featherweight clamp Model ST 250D but equipped with twin flanged gussets welded to the underside of the base to provide a means of mounting in line with the clamping pressure.

Several advantages are claimed for these FM series clamps on certain types of work. For instance, on assembly work where clamps usually have to be positioned outside the workpiece, it has been necessary in the past to extend the base plate of the assembly fixture to accommodate the clamp. These front-mounting clamps can be fitted to the edges of the fixture base-plate, thereby reducing the size and weight of the complete fixture.

Flat clamps are also available with this type of base and in addition there is a model with an integral cast base and a sloping arm.

Tube-straightening Machine

IN the "Bronx" 6.C.R. series tube-straightening machines (Fig. 6) the tube to be straightened is passed through three pairs of rolls and the deflexion on the tube which is necessary in order to straighten it, is applied by adjusting both the centre rolls in relation to the outside rolls. All the top rolls can be adjusted vertically to suit tubes of differing diameters and the bottom centre roll is also adjustable vertically to apply the deflexion mentioned above. In addition the angle of all the rolls can be adjusted so that whatever tube is being straightened, full line contact can be assured.

It should be noted that in the case of this 6.C.R. Series all 6 rolls are driven and this enables straightening to be carried out without in any way marking the surface of the tubes.

The standard range of machines will straighten ferrous and non-ferrous tubes from 0.02 in. to 12 in. diameter, and according to circumstances the machines can be built for single-, two- or three-speed operation. The manufacturers can also offer inlet and outlet troughs and these can be of a simple type, or if required can be arranged for automatic discharge of the tubes as they pass through the straightening machine.

The machine shown is the Series 6.CR.5 capable of handling tubes from ½ in. to 2 in. diameter.

Full details are available from the Bronx Engineering Co. Ltd., Lye, Nr. Stourbridge.

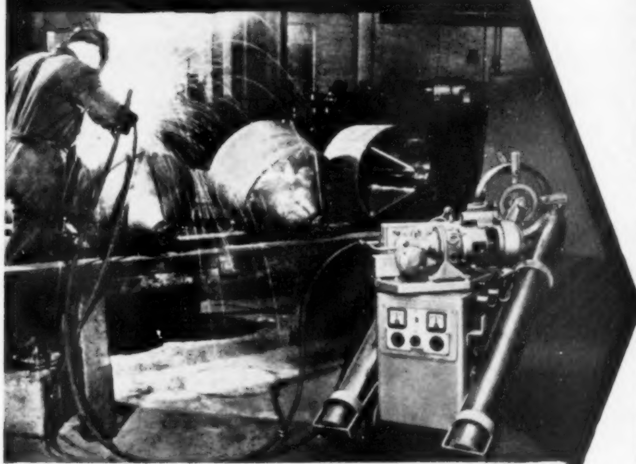
Deburrer

THE "Speedy Vee" deburrer (Fig. 7) is available from Dennis Radford, 14, Mandeville Road, Potters Bar, Middlesex. It is said to be suitable for removing sharp edges from sheet metal, plastics, etc. In operation, the thumbscrew is released and the blades (which can be replaced as necessary) adjusted to the required setting.

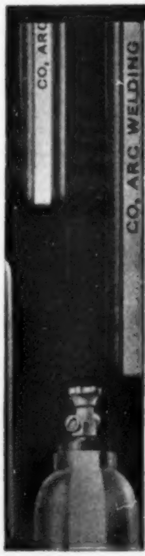
The thumbscrew should be pointing away from the user at all times, with the V-blades resting on the sharp edges. The tool is tilted to about 45 deg. The tool is then drawn towards the user. If the material being deburred is of light gauge it is suggested that the blades are set to a sharp cutting edge. The tool is very inexpensive, as also are the replacement blades.

Fig. 7.—Deburrer

behind the latest CO_2 arc welding techniques . . .



Twelve pounds of metal per hour can be deposited by this new Philips CO_2 arc welding unit using cheap, low pressure carbon dioxide shielding. For constant weld quality, Philips recommend D.C.L.'s constant composition CO_2 in the newly designed syphon cylinder.



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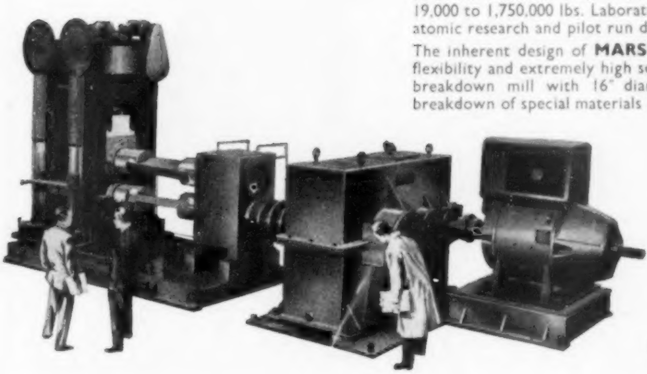

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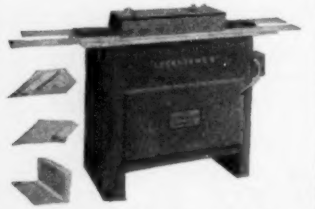

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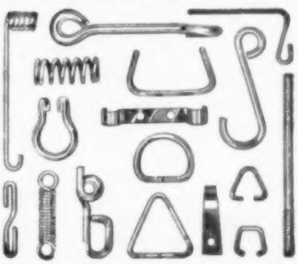

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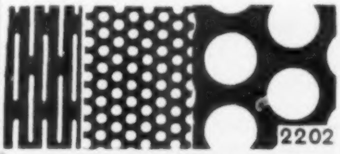

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